The Roles of Perceived Conflict and Self-relevance in Processing Contradictory Health Information

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ABSTRACT

A growing body of research has shown that media exposure to contradictory health information can produce public confusion, generate negative beliefs about scientific research, and lower intentions to perform recommended health behaviors. To mitigate such adverse effects, effective communication and public health interventions are needed. However, less scholarly attention has been paid to the information processing of contradictory health messages. This dissertation furthers our understanding of the mechanisms of contradictory health information processing by asking two questions: (1) Are cognitive and affective effects of exposure to contradictory health messages mediated by *perceived conflict*, and (2) does the level of *self-relevance* prompt differential processing of contradictory health messages?

To address these questions, I conducted a two-wave survey experiment. To test the potential moderating effects of self-relevance, it is important to select an appropriate health topic which allows variances in the level of self-relevance. Wave 1 survey (N = 1944), therefore, asked participants to report how frequently they performed eight routine health behaviors and rate how important it was to perform each behavior. I identified coffee consumption as the health context for Wave 2 because it had an approximately equal number of participants with varying levels of self-relevance. Wave 2 Study 1 (N = 649) tested whether exposure to contradictory health messages is linked to perceived conflict, and whether relatively high self-relevance prompts defensive processing of contradictory health messages. Results showed that perceived conflict was significantly greater among participants in the contradictory messages condition than

those in comparison conditions with one-sided, convergent messages. Additionally, both high self-relevance (i.e., heavy coffee drinkers who think drinking coffee is important) and low self-relevance (i.e., non-routine coffee drinkers who think drinking coffee is unimportant) individuals engaged in defensive processing of the dissonant message that contradicted their strong prior beliefs and/or behaviors. Study 2 (N = 846) tested whether perceived conflict leads to subsequent adverse cognitive and affective responses of exposure to contradictory messages, and whether these responses differ by self-relevance. Results demonstrated that perceived conflict induced by exposure to contradictory messages was overall associated with greater topic-specific confusion, general confusion, ambivalence, anger, and fear; but not backlash, media skepticism, or surprise. Also, these effects did not vary by self-relevance.

Taken together, due to empirical inconsistencies across the outcomes, it is difficult to reach a clear conclusion whether perceived conflict always functions as a mediator in contradictory health information processing. Additionally, those holding strong priors are more likely to engage in defensive processing of contradictory messages, but such processing does not result in differential effects of exposure to conflict. The implications of these findings for addressing potentially adverse effects of exposure to contradictory health messages are discussed.

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INTRODUCTION

Due to the complexity of health and science issues, coupled with the journalistic norm of balanced reporting, health news coverage is often characterized by conflicting and controversial information. For example, a news story from the Guardian reported "*Moderate drinking can lower risk of heart attack, says study*," whereas another story from the CNN wrote "*Study: Moderate drinking ups risk of breast cancer return*." Similarly, an article from the Forbes covered a study that found "*Screening mammography lowers breast cancer patients' needs for aggressive treatment*" while another story from the Washington Post focused on other studies that suggested "*Mammograms leading to unnecessary treatment*." At the moment, COVID-19 is another health topic—perhaps the most salient one—that is flooded with conflicting information. Media coverage has given substantial attention to disagreement among politicians and health experts over a wide range of prevention and treatment related issues (e.g., whether face masks can help prevent the spread of the coronavirus). More importantly, these conflicting messages have been noted by the public (Nagler et al., 2020; Pew Research Center, 2020a).

There is good evidence that exposure to conflicting health messages can have adverse consequences, such as more negative emotional responses (e.g., frustration, annoyance, distress) (Nagler et al., 2019), heightened confusion and uncertainty about the health issue (Chang, 2015; Katz et al., 2018; Lee et al., 2018; Vardeman & Aldoory, 2008), decreased credibility of mass media and/or scientific research in general (Chang, 2015; Herbert, 2020; Jensen & Hurley, 2012), lowered behavioral intentions to perform advocated health behaviors (Carpenter et al., 2014; Dixon & Clarke, 2012; Nagler,

2014), and reduced policy support for regulating potentially unhealthy products (Tan et al., 2015). Given that such deleterious effects could be detrimental to public health, there is a need for effective communication and public health interventions to address conflicting health information and its downstream consequences.

The objectives of this dissertation are to contribute to the still-nascent literature on conflicting health information processing and to inform future intervention strategies. Any successful intervention hinges on a clear understanding of the process of *how* and *why* negative affective, cognitive, and behavioral outcomes occur. Thus, understanding how conflicting health information is processed, particularly by identifying any intermediate variables between conflicting exposure and its subsequent effects, would yield valuable insights for intervention strategies. Targeting not only the ultimate outcomes but also key mediators may enhance the efficiency and effectiveness of interventions, because certain mediators that relate to the ultimate outcomes (e.g., unhealthy behaviors) might be potentially more modifiable (Sheeran et al., 2017). Yet, systematic examination of conflicting health information processing is lacking.

Additionally, when confronted with conflicting messages, people may process such messages differentially. For example, women who have had a recent mammogram are more likely to perceive information about potential harms of mammography (e.g., overdiagnosis) as less believable and persuasive than potential benefits (e.g., early detection of breast cancer), compared to women without a strong record of screening (Nagler et al., 2017). In the context of conflicting recommendations about e-cigarette use (e.g., potential benefits of cessation aid, potential harms of long-term health effects), Yang et al. (2020) found that e-cigarette confusion after exposure to conflicting

recommendations varied by one's information avoidance tendency to maintain uncertainty—only those with low level of information avoidance showed more confusion when presented with conflicting recommendations. Therefore, it is conceivable that intervention strategies addressing adverse effects of exposure to conflicting health information may vary greatly across different subgroups.

To further our understanding of the mechanisms of conflicting health information processing, this dissertation connects psychological theories, which explain defensive responses to dissonant and self-relevant information, with health communication science, which explains effects of media exposure to conflicting health messages. Specifically, I ask two overarching questions: 1) are effects of exposure to contradictory health information mediated by perceived conflict, and 2) does the level of self-relevance prompt differential processing of contradictory health information? This dissertation provides a more detailed explanation for the effects of exposure to contradictory messages and practical implications for public health interventions, particularly when potentially deleterious outcomes arise.

Chapter 1 of this dissertation provides a review of the literature on key concepts of perceived conflict and self-relevance in the context of conflicting health messages. Given limited empirical support for perceived conflict after exposure to contradictory messages, I conducted an exploratory study to probe whether people would recognize conflict across distinct health messages even when the existence of conflict or disagreement is not underscored in such messages. Details and implications of the exploratory study are also included in Chapter 1.

Chapter 2 first outlines conceptual model of effects alongside hypotheses and research questions and then offers an overview of the study design. To test the potential moderating effects of self-relevance, a health topic associated with varying level of self-relevance needs to be selected. Thus, I conducted a two-wave, between-subject experimental design: Wave 1 aimed to select the appropriate health topic from eight potential candidates; Wave 2 aimed to test the proposed model of effects.

Chapter 3 reports Wave 1 ($N = 1944$), which yielded coffee as the Wave 2 health context as it had the most equal distribution of participants with different self-relevance levels.

Chapter 4 reports Wave 2, which included two studies (i.e., Study 1 and Study 2) that tested different sets of hypotheses and research questions. Specifically, Study 1 ($N = 649$) examined whether exposure to conflicting health messages is linked to perceived conflict, and whether relatively high self-relevance prompts defensive processing of dissonant health information. Study 2 ($N = 846$) tested whether perceived conflict is associated with adverse affective and cognitive responses of exposure to conflicting health messages, and whether these responses differ by self-relevance. Study 1 and Study 2 together demonstrate whether perceived conflict functions as a mediator between exposure to contradictory messages and subsequent outcomes, and whether self-relevance renders differential processing of such contradictory messages.

Last, Chapter 5 presents a summary of research findings and discusses theoretical and practical implications.

CHAPTER 1: THEORETICAL BACKGROUND

Overview

In the first chapter of this dissertation, I focus on two key concepts, perceived conflict and self-relevance, by reviewing prior literature on the conceptualizations of these concepts as well as their roles in contradictory information processing. In addition, I describe an exploratory thought-listing study that provided initial support for the link between exposure to contradictory health messages and perceived conflict and explain the outcomes of interest included in this dissertation.

Perceived conflict and contradictory health messages

Contradictory or conflicting messages can be conceptualized as messages that "offer information about the same behavior producing two distinct outcomes," (Nagler & LoRusso, 2018, p. 3) which highlights the decisional conflict—if one should perform the behavior or not; or as those that "provide competing claims about a particular behavior resulting in a particular health outcome," (Nagler & LoRusso, 2018, p. 3) which reflects the informational conflict—how to perform the behavior in order to achieve the desirable health outcome. Think about mammography screening as an example. Decisional conflict might arise when a woman is faced with two contradictory news articles discussing the potential benefits and harms of mammography; one of them might say mammography could detect breast cancer early and thus save lives but the other one might indicate mammography could lead to harmful overdiagnosis and subsequent overtreatment. In this scenario, the same behavior (i.e., mammography) may

produce two distinct outcomes (i.e., potential benefit of cancer detection and potential harm of overdiagnosis). Informational conflict, on the other hand, might occur when a woman has learned about inconsistent mammography guidelines (e.g., the U.S. Preventive Services Task Force recommends biennial routine screening for average-risk women aged 50 to 74 years while the American Cancer Society recommends beginning routine mammograms every year at age 45). Early cancer detection is the desirable health outcome in this case; however, how best to achieve this outcome remains unclear due to the competing claims.

There are two ways that people may encounter contradictory health information: *messages about contradiction* and *contradictory messages*. Unlike *messages about contradiction*, which highlight the contradiction or conflict in a single story, *contradictory messages* refer to multiple distinct exposures, in which the contradictory "other side" is not mentioned in the same story (Nagler & LoRusso, 2018). For example, one news story might report that "Moderate drinking can lower risk of heart attack, study says," whereas another news story might report "Study: even moderate drinking ups risk of cancer." Here, no contradiction is underscored in either headline. The underlying assumption for effects of exposure to contradictory messages is that people may infer conflict after exposure. However, more empirical evidence is needed to substantiate this claim. Thus, by focusing on information processing of contradictory messages, this dissertation examines whether people actually perceive conflict after reading contradictory health messages. For information processing of messages about contradiction, perceived conflict also should be an important intermediate factor but it may be less critical here, because recognizing conflict may be less demanding for people

since conflict is explicitly underscored in a single message. Also, it is worth mentioning that given the nascent evidence base for contradictory information processing, this dissertation solely focuses on contradictory health messages that might induce *decisional conflict*. Effects of exposure to messages reflecting *informational conflict* may follow the same path but are beyond the scope of the current study and can be examined in future research[1].

Researchers examining the effects of exposure to contradictory information have used survey and experimental methods. In survey studies, contradictory information exposure is often assessed by directly asking respondents how much conflicting or contradictory information they have heard from media (e.g., Nagler, 2014) or how often they have received conflicting or contradictory information from multiple sources (e.g., Carpenter et al., 2010; 2014). In general, messages about contradiction are not differentiated from contradictory messages in such studies. Another approach to capturing contradictory information exposure is asking respondents to report how often they heard from the media about a positive health consequence and a negative health consequence separately for a health issue (e.g., Nagler & Hornik, 2012). If a respondent recalled hearing both the positive and negative side, then he/she was exposed to contradictory information. As discussed by Nagler and Hornik (2012), although the face validity for these two measures of contradictory exposure is high, there might be some differences in what they actually capture. To be specific, the former approach requires

[1] As detailed below, to test the moderating effects of self-relevance, a health topic (or behavior) associated with approximately equal number of participants with varying levels of self-relevance needs to be selected. Compared to decisional conflict, it is more difficult to find or devise competing claims that reflect informational conflict for common health topics (or behaviors). So, I focused on decisional conflict when operationalizing contradictory health messages in this dissertation.

respondents to recognize conflict after exposure, which may measure perceived conflict rather than true past exposure. In contrast, respondents do not need to have a perception of conflict when reporting their awareness of positive or negative consequences for a given topic.

Although experimental work on this topic forces contradictory information exposure on respondents, it typically includes a manipulation check (e.g., "how much conflicting information did you notice in the messages?") to assess whether respondents have in fact recognized the contradiction in the stimuli messages (e.g., Chang, 2015; Nagler et al., 2019). If a respondent did not perceive conflict after exposure, then there would be nothing for him/her to be confused or ambivalent about. In other words, it is not the mere exposure per se that leads to the outcomes, but the psychological state of perceived conflict after exposure.

Yet, it remains a question whether contradictory information exposure is always linked to perceived conflict. Perhaps the question becomes less of an issue when messages about contradiction are involved. Since contradiction is underscored in such messages, it would be easier for people to infer conflict. In contrast, the effects of exposure to contradictory messages delivered by multiple distinct news stories heavily depend on an audience's ability to infer conflict across stories. If one could recognize the incompatibility between two messages, then it is likely that this perceived conflict could in turn lead to subsequent outcomes.

Conceptualizing perceived conflict

Perceived conflict refers to an individual's recognition of conflict. The Merriam-Webster Dictionary defines the noun "conflict" as "competitive or opposing action of

incompatibles: antagonistic state or action (as of divergent ideas, interests, or persons)" ("Conflict," n.d.). Conflicts are an unavoidable part of human activities. Indeed, scholars have studied the concepts of conflict at multiple levels—individual, interpersonal, group, organizational, and even societal—across domains of social science research (e.g., Brassard et al., 2009; Canary & Spitzberg, 1989; Flannery et al., 1993; Worley & Samp, 2016; Gutek et al., 1991; Shin & Cameron, 2004). Across these studies, there is no consensus on the definition of conflict. Below I provide several examples of conceptualizations of perceived conflict and then offer my definition of perceived conflict for the current study.

At the individual level, perceived work-life conflict may arise when one thinks there is an incompatibility between performing the role in the work domain versus the role in other domains such as family (Gutek et al., 1991; Jiang & Shen, 2013). At the interpersonal level, research has examined the influence of relational conflict between couples as well as between parents and adolescents on emotions and behaviors (Canary & Spitzberg, 1989; Flannery et al., 1993; Worley & Samp, 2016). Such conflict has often been conceptualized as the perceived incompatible goals and actions between independent parties, which may elicit negative emotions and affect relationship satisfaction and stability (Brassard et al., 2009; Young, 2004). Likewise, perceived conflict has been studied at the group level. For instance, one of the reasons for the conflicts between public relation practitioners and journalists might be that the communicative roles and goals of these two professions are at odds: Public relation practitioners serve as information senders with a goal to advocate for media coverage

whereas journalists perform as information receivers who aim to pursue objectivity (Shin & Cameron, 2004; 2005).

As noted in prior work, not only could conflict occur at different communication levels, the concept could also be examined at different dimensions (i.e., cognitive, affective, and behavioral) (Pondy, 1967). In particular, cognitive state of conflict may refer to an individual's perception or awareness of a conflictual situation; affective state of conflict may reflect a psychological tension, stress, and anxiety; and behavioral state of conflict may involve aggression (Pondy, 1967). While research has shown that being in conflict could lead to negative emotions, some scholars have argued that conflict itself is in fact emotionally defined and driven (Zhang et al., 2013). Additionally, if conflict becomes intense and stays unresolved, it often evokes sensemaking activities since humans strive to understand and resolve conflicts (Zhang et al., 2013). Engaging in cognitive activities to understand conflict also may cause stress and uncertainty (Bar-Tal, 2000). When people formulate various beliefs to cope with perceived conflict, stress and uncertainty may be reduced accordingly; however, this process of beliefs formation is always biased because strong motivations (e.g., ego defense) typically underlie the information processing of conflictual situations (Bar-Tal, 2000).

Perhaps more germane to the current study, conflicts are widely mentioned in political news reporting (i.e., conflict frames), emphasizing "incompatibilities, disagreements, or oppositional tensions between individuals, groups, and institutions" (Putnam & Shoemaker, 2007, p. 167). Conflict frame—as one of the most commonly used media frames in coverage of political and social issues—is considered a useful approach to capturing public attention (Bartholomé et al., 2015; Semetko & Valkenburg,

2000). Exposure to conflict-framed news may influence different aspects of individuals' political life. For example, using conflict frames in campaign news has been found to effectively increase voters' mobilization (Schuck et al., 2016). However, conflict frames may also decrease public policy support (Vliegenthart et al., 2008) and induce polarization (Han & Federico, 2018). In addition to the effects of exposure to conflict frames, prior research has examined the possible mechanisms of processing conflict frames (e.g., Price, 1989; de Vreese, 2004). Drawing on the self-categorization theory, Price (1989) argued that a conflict-framed news report may cue its readers to think about the issue through their own group perspective, which in turn, may elicit polarized or exaggerated perceptions of group opinions and lead to attitudes and behaviors that are consistent with such polarized perceptions. Similarly, existing studies have found that when self-categorization is activated, individuals often perceive there is a conflict between ingroup and outgroup (Keltner & Robinson, 1997; Riketta, 2004; Rothbart & Hallmark, 1988; Schmid & Muldoon, 2015). Notably, most conceptualizations of conflict in prior studies imply personal involvement to some extent. In other words, these studies either examined individuals who were in situations of conflict or exposed individuals to conflict-framed messages that may activate self-concept (e.g., self-categorization).

Just as media coverage of political issues can be framed with conflicts, so, too, can media coverage of health and science issues highlight contradictory findings. In accordance with prior research and the conceptualization of contradictory messages, this dissertation defines *perceived conflict as an individual's awareness and cognitive recognition of inconsistency between at least two separate messages*. It is assumed that

after exposure to contradictory health messages people may infer conflict, and this perceived conflict may lead to subsequent cognitive and affective outcomes such as confusion and ambivalence.

Perceived conflict and cognitive dissonance

To better understand the concept of perceived conflict in the context of contradictory information, it is useful to consider the concept of "dissonance" in Festinger's cognitive dissonance theory (Festinger, 1962). According to the theory, cognitive dissonance arises when people recognize inconsistency or contradiction among their cognitions and/or behaviors. New information or events may create dissonance with existing knowledge, opinions, or behaviors. The presence of dissonance induces a feeling of discomfort and makes people feel pressured to reduce or eliminate the dissonance. In the example provided in Festinger's book, if a smoker learns that smoking is bad for his health, dissonance would be aroused between what he does and what he knows, which might make him feel discomfort. To reduce this dissonance, he might change his smoking behavior (e.g., reduce the number of cigarettes smoked) or change his knowledge about the harmful effects of smoking (e.g., downplay the harms caused by smoking).

While the concepts of dissonance and perceived conflict are related, there are some differences between the two that are worth noting. First, as articulated in cognitive dissonance theory, the inconsistency between two cognitions induces a feeling of discomfort, which motivates individuals to reduce the dissonance. The description of a feeling of discomfort implies that dissonance in fact has an emotional component (Martinie et al., 2013). Similarly, some scholars have argued that conflict is also

emotionally charged (e.g., Zhang et al., 2013). While conflict may be a multifaceted concept and include cognitive, affective, and behavioral dimensions (Pondy, 1967), the current study focuses on the cognitive component of it, namely perceived conflict, and examines negative emotions as outcomes of perceived conflict.

Second, in Festinger's original theory, although not specified, the consistency mostly refers to internal consistency—one's opinions, attitudes, beliefs, and behaviors tend to be consistent within oneself. Later extended by Aronson (1997), "dissonance is greatest and clearest when what is involved is not just any two cognitions but, rather, a cognition about the self and a piece of our behavior that violates that self-concept" (p. 131). In other words, dissonance most likely arises when there is a threat to the self: The engagement in a bad or foolish behavior challenges one's self-image as a good or intelligent person (Greenwald & Ronis, 1978; Kunda, 1990). This speculation is also supported by the evidence that self-affirmation of a valued aspect of the self could eliminate dissonance reduction and attitude change effects (Steele & Liu, 1983). Thus, the concept of dissonance mostly applies to situations when self-concept is violated while perceived conflict arises regardless of the violation of self-concept.

Self-relevance and contradictory health messages

The strategies of dissonance reduction or perceived conflict resolution can include a range of so-called defensive processing, which often occurs when an individual is confronted with a message that is inconsistent with his or her prior belief or committed behavior (Dillard et al., 2018). For example, by analyzing focus group comments, Vardeman and Aldoory (2008) identified several cognitive negotiation

tactics used by women to understand the risk of eating fish when they were confronted with contradictory media messages about fish consumption safety. Although not all of these tactics manifested defensive processing, one particular tactic did indicate defensive processing in situations of encountering personally relevant contradictory health information. That is, women were likely to filter out certain information that countered their prior beliefs and behaviors of fish consumption. In addition, they also found that high personal relevance elicited more negative emotional responses such as fear, anger, and guilt. Likewise, in the context of contradictory vaccine-related messages, Nan & Daily (2015) found that individuals often displayed so-called biased assimilation, which is similar to defensive processing insofar as individuals tend to selectively credit information that confirms their prior beliefs.

Personal relevance has also been examined extensively in the research domain of information processing and persuasion. According to some dual information processing models (e.g., Elaboration Likelihood Model, Heuristic Systematic Model), personal involvement or motivation is more likely to trigger active and deep processing of information (Liberman & Chaiken, 1992; Petty & Cacioppo, 1990). Although this dissertation is not guided by dual information processing models given persuasive outcomes are not the focus, some scholars have found that exposure to conflicting information may prompt systematic information processing even when involvement or motivation is low (e.g., Katz et al., 2018). Thus, it is likely that both high-relevance and low-relevance individuals may process conflicting information systematically but the former group would engage in biased systematic processing and the latter would engage in unbiased systematic processing.

Defensive processing and self-concept

Health communication messages often present threatening health information to people so that they can change their behaviors to become healthier. Not all health messages are designed with a persuasive purpose; nevertheless, these messages may contain threatening health information and exert an impact on people's beliefs and behaviors. If an individual encounters contradictory health messages with threatening health information that challenges his/her view of oneself as an adequate healthy person, he/she may engage in defensive processing (van 't Riet & Ruiter, 2013). Defensive reactions may include avoiding the information purposely, derogating the information source, downplaying the severity and susceptibility of the risk, and so forth (Good & Abraham, 2007). Being confronted with inconsistent or dissonant information against one's adequate self, people may use these strategies to reduce dissonance or resolve perceived conflict (Liberman & Chaiken, 1992; Dillard et al., 2018). In other words, information is more likely to be processed defensively when the information is highly personally relevant. For example, Liberman and Chaiken (1992) found that heavy coffee drinkers (i.e., high-relevance participants) considered the caffeine-fibrocystic disease link less believable and listed more weaknesses in the dissonant message than light coffee drinkers (i.e., low-relevance participants). Similarly, in a survey conducted by Nagler et al. (2017) assessing women's awareness of potential harms of mammography screening, those with a recent record of mammogram (i.e., high-relevance individuals) perceived overdiagnosis and overtreatment statements to be less believable.

As noted in prior research, perhaps the most salient reason for defensive processing is to maintain the self-concept (e.g., Aronson, 1997; Dillard et al., 2018;

Steele, 1988; Tesser, 2000). As a multifaceted concept, the self-concept can be considered as a collection or representation of beliefs, schemas, conceptions, evaluations, goals, theories, prototypes, and so forth about oneself (see Markus & Wurf, 1987 for a review). Most individuals strive to preserve a consistent, competent, and morally good sense of self (Aronson, 1997). So, when a new piece of information challenges one's positive self-concept, defensive processing might occur. In the coffee example above (Liberman & Chaiken, 1992), heavy coffee drinkers defensively processed the information that threatened their view of an adequate healthy self.

Likewise, think about two health news headlines in the context of contradictory health information, "Moderate drinking can lower risk of heart attack, says study" and "Study: Even moderate drinking ups risk of cancer." Due to the inconsistency between these two headlines, one may recognize the conflict between the two messages no matter whether he/she drinks or not. However, drinking behavior may influence how the two headlines are actually processed. A non-drinker may simply try to make sense of the two contradictory headlines whereas a drinker, who thinks drinking is part of who he/she is, may try to reduce dissonance because one of the headlines is inconsistent with his/her committed behavior. Thus, it is likely that the hypothetical drinker may engage in a series of reasoning to arrive at the conclusion that the outcome of drinking is not that undesirable because the argument of the dissonant message (i.e., "Study: Even moderate drinking ups risk of cancer), which argues against drinking behavior, as less convincing or the source as less credible. In contrast, the non-drinker may rate the two messages as equally believable and credible. As a result, the drinker may be less confused about drinking than the non-drinker after contradictory messages exposure. To sum up, there is

reason to believe that when encountering contradictory health messages, one may engage in defensive processing if the health issue in question is highly personally relevant.

Conceptualizing self-relevance

Much of the conceptualization work about personal relevance has been conducted by social psychologists and consumer behaviorists, who have considered personal relevance as a key characteristic of involvement (e.g., Andrews et al., 1990; Greenwald & Leavitt, 1984; Zaichkowsky, 1986). For example, Greenwald and Leavitt (1984) defined involvement based on attentional and cognitional resources allocation: Compared with low-involvement, high-involvement requires greater capacity and leads to durable cognitive and attitudinal effects. In a series of articles, Zaichkowsky (1985; 1986; 1994) argued that involvement could be categorized as involvement with advertisements, with products, or with purchase decisions and defined involvement as "a person's perceived relevance of the object based on inherent needs, values, and interests" (Zaichkowsky, 1985, p. 342). In addition, Andrews et al. (1990) argued that involvement may be defined based on an individual's internal state of arousal in terms of intensity, direction, and persistence properties.

Alternatively, social psychologists who study personal relevance and information processing have provided different conceptualizations and focused on a set of different persuasion outcomes (e.g., Johnson & Eagly, 1989; Petty & Cacioppo, 1990). For instance, Johnson and Eagly (1989) categorized three types of involvement, value-relevant involvement (i.e., topic of the persuasive message is linked to important values), outcome-relevant involvement (i.e., topic of the persuasive message is linked to

current important goals or outcomes), and impression-relevant involvement (i.e., individual's response to the topic of the persuasive message matters).

As noted by Celsi and Olson (1988), perceived relevance is an essential characteristic of involvement. An individual's level of involvement with an informational stimulus is determined by the degree to which the individual feels it to be personally relevant. They further explained that "a concept is personally relevant to the extent that consumers perceive it to be self-related or in some way instrumental in achieving their personal goals and values" (p. 211). Perhaps more importantly, they emphasized the importance of *felt involvement*, which refers to an individual's overall subjective feeling of relevance. Under some circumstances, even though an object or event may seem to be important to an individual, he/she may not always perceive it as relevant. Manipulating personal relevance in a message does not equal to receivers' actual experience of personal relevance.

Although the focus of distinct conceptualizations varies slightly, they are grounded in the same assumption: A message is personally relevant because it is related to a variety of self-relevant constructs such as one's values and goals. In other words, the most personally relevant, important, involving message would be one about the self (Petty & Cacioppo, 1990). Given the centrality of the self in information processing, perhaps it is more accurate to use the term self-relevance rather than personal relevance in this dissertation.

As explained above, when faced with contradictory messages, if an individual considers the issue as highly self-relevant, he/she may engage in defensive processing. Then when would someone perceive a threat to the self and be motivated to maintain the

self? Maybe when one has a committed behavior and considers it as part of the self. For example, compared to a light coffee drinker, it is more likely for a heavy coffee drinker to defensively process the information about negative health consequences of caffeine consumption. Similarly, among coffee drinkers, some of them might think coffee means a lot whereas others might think coffee is unimportant. Those who perceive coffee as important to the self are more likely to engage in defensive processing. Thus, to completely capture the concept of self-relevance in processing conflicting health information, it is necessary to assess *both one's prior behavior and perceived relevance/importance of performing the behavior*.

Although there is some evidence for the adverse effects of exposure to contradictory messages, few studies have examined whether such effects differ by individual difference or personal factors (e.g., self-relevance). In unpublished dissertation work, using a cross-sectional survey, Nagler (2010) examined the potential moderating effects of prior nutrition behavior on the relationship between exposure to contradictory nutrition information and nutrition confusion. Across four selected nutrition topics (red wine or other alcohol, fish, coffee, and vitamins/supplements), only coffee consumption was found to moderate the exposure–confusion relationship to some extent. Those who had weak priors showed greater nutrition confusion than those with strong priors. Another personal factor that may induce differential processing of contradictory information is information avoidance tendency. Yang et al. (2020) found that exposure to contradictory recommendations about e-cigarette use increased e-cigarette confusion among those with low information avoidance tendency but not among those with high information avoidance. Building upon prior research, this

dissertation considered the personal factor of self-relevance and examined whether effects of contradictory exposure varied by this factor.

Effects of exposure to contradictory health messages

Media exposure to contradictory health information may negatively influence people's cognitive and affective responses (e.g., Chang, 2015; Lee et al., 2018; Nagler et al., 2019; Vardeman & Aldoory, 2008). Potential cognitive outcomes may include confusion (defined as perceived ambiguity about the health topic in question or health research in general) (Nagler, 2014), ambivalence (defined as holding simultaneously positive and negative attitudes toward the health topic in question) (Thompson et al., 1995), and backlash (defined as negative beliefs or attitudes toward health recommendations and scientific research) (Nagler, 2014).

Decision theory provides theoretical support for why confusion may arise after exposure to contradictory information by explaining that "ambiguity may be high…particularly where there is conflicting opinion and evidence" (Ellsberg, 1961, p. 659). For many people, such perceived ambiguity may induce a feeling of discomfort ("ambiguity aversion"), which may manifest itself in pessimistic and biased beliefs or interpretations toward the subject of ambiguity (e.g., Han et al., 2006). For example, if people perceive ambiguity about cancer screening, they may become pessimistic about cancer prevention (e.g., lower preventability beliefs) and have negative beliefs toward cancer research and prevention (i.e., backlash). Similar to but conceptually distinct from perceived ambiguity is another potential outcome: attitudinal ambivalence. It is conceivable that after learning both pros and cons of performing a health behavior,

people may simultaneously evaluate the behavior positively and negatively, thus having mixed feelings about the behavior. These three cognitive outcomes (confusion, ambivalence, and backlash) have been examined in prior research, and their causal relations with exposure to contradictory information have been substantiated through experimental and panel studies (e.g., Lee et al., 2018; Nagler et al., 2019).

Another potential cognitive outcome—identified through an exploratory thought-listing detailed below—is media skepticism (defined as a subjective feeling of mistrust toward the news media) (Tsfati & Cappella, 2003). Since contradictory messages are often distributed by media outlets, people may also view news media as the subject that introduces ambiguity. By extension, people may form negative beliefs and attitudes toward news media after exposure to contradictory information. There is evidence that people discount news or journalists' credibility following such exposure (e.g., Chang, 2015; Shi et al., 2021).

In addition to cognitive outcomes, exposure to contradictory information may also evoke affective responses. For example, Nagler et al. (2019) found that exposure to conflicting news stories about mammography screening increased women's negative emotional responses—frustration, annoyance, and distress—to the story they read. Affect is an umbrella term that encompasses all sorts of feelings (Dillard & Seo, 2013). According to appraisal theory, "emotions are elicited by evaluations (appraisals) of events and situations" (Roseman & Smith, 2001, p. 3). These evaluations are relative to one's goals (Dillard & Nabi, 2006). So, if the goal is to stay healthy, then in the context of exposure to contradictory health messages, fear may arise because the messages may contain information about health risks; anger may arise because the messages present

conflicting opinions about how to reduce such risks. Consistent with this theoretical rationale, the current study focuses on negative, discrete emotions, particularly anger and fear. Although surprise may not be a negative emotion, it was also included in the study as it was mentioned by respondents in an exploratory thought-listing study detailed below.

A thought-listing exploratory study

This dissertation proposes that people may infer conflict when encountering contradictory messages, and this perceived conflict will lead to subsequent cognitive and affective outcomes that have been examined in previous work, such as confusion, ambivalence, backlash, anger, and fear. In other words, effects of exposure to contradictory messages are presumed to operate through perceived conflict. Yet it is not known 1) if people do in fact infer conflict after exposure to contradictory messages, and/or 2) if there are other outcomes beyond those listed above. To answer these questions, I conducted an exploratory study drawing on the thought-listing technique in January 2019.

Sample and procedure

A total of 200 participants were recruited on Amazon Mechanical Turk. To avoid priming conflict, participants were simply asked to view some health news headlines (or briefs) and read them carefully. Participants were then randomly assigned to one of two contradictory exposure conditions—contradictory news headlines (n = 99) or contradictory news briefs (n = 101)—about four health topics, nutrition, e-cigarettes, mammography screening, and PSA testing (see Appendix A for specific messages). The order of seeing each health topic was fully randomized. Following each exposure to

conflict, participants were told that "we are now interested in what you were thinking about when you were reading the news headlines (or briefs)" and asked to record all of their thoughts and ideas about the headlines (or briefs) they just read. In total, each participant provided four groups of thoughts.

The ages of participants ranged from 20 to 66 years with an average of 33.63 (*SD* = 9.60). Of all participants, 68% were male; 58.5% identified as white, non-Hispanic, 18% identified as Asian, 15% identified as Hispanic, 4.5% identified as Black, non-Hispanic, and 2% identified as American Indian or Alaska Native[2]. A majority of participants had at least some college education (84.5%)[3]. Because perceptions of conflicting information about e-cigarettes may vary by smoking status, participants were also asked to report their then-current use of cigarettes and e-cigarettes. Just over half of participants indicated that they had smoked at least 100 cigarettes in their entire life (51%). Additionally, 13% reported that they smoked cigarettes every day, 23.5% said they smoked cigarettes some days, and 63.5% indicated they did not smoke cigarettes at all. As for e-cigarette use, 48.5% reported having used an e-cigarette, even one or two times. Also, 71.5% indicated they did not use e-cigarettes at all, while 7% used e-cigarettes every day and 21.5% used e-cigarettes some days[4].

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[2] To assess participants' race/ethnicity, two questions were asked: "Are you of Hispanic, Latino/a, or Spanish origin?" with response options of "yes" and "no" and "What is your race? One or more categories may be selected" with response options of "White," "Black or African American," "American Indian or Alaska Native," "Asian," and "Native Hawaiian or Pacific Islander."

[3] Participants responded to the question: "What is the highest grade of level of schooling you completed?" Of all participants, 57% completed college, 19.5% had some college education, 8% had postgraduate degree, 3% had post high school training other than college, 12% completed high school, and .5% had less than high school education.

[4] Additional analyses regarding whether perceived conflict varied by smoking status were included in Appendix B. Non-vapers were more likely to report perceived conflict than vapers after exposure to contradictory news headlines about e-cigarettes. However, this pattern was not found for those exposed to

Analysis and results

On average, participants spent about 10 minutes 30 seconds completing the survey. Participants' thoughts were coded for perceived conflict. If a response contained one or more thoughts that referred to contradictions or inconsistencies across messages, then this response indicated perceived conflict. Some keywords were pre-determined to help locate thoughts about perceived conflict: "inconsistent/inconsistency," "contradictory/contradict/contradiction," "conflicting/conflicts," "different (conclusions/guidelines/evidence)/differences" and "opposite." Other words and phrases used by respondents included "change often," "both good and harmful," "counterarguments," "…positive, …negative," "two sides," "dissenting," "…benefits, …risks," "contrasting," "pros and cons," "in oppositions," "go against" "split down the middle," and "at odds." Note that given the exploratory nature of this study, I did not have a second coder to look through participants' thought-listing responses, which prevented me from establishing inter-coder reliability. Thus, all findings need to be interpreted with caution.

Analyses showed that more than 50% of respondents perceived some conflict in at least one of the four groups of messages (see Table 1.1 below for specific distribution).

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contradictory news briefs. Also, perceived conflict did not seem to differ between smokers and non-smokers.

Table 1.1 *Percentage of perceived conflict reported in thought-listing responses*

	Headlines condition *n* (%)	Briefs condition *n* (%)	Total *n* (%)
Did not perceive conflict	35 (35.4%)	56 (55.4%)	91 (45.5%)
Perceived conflict about one topic	30 (30.3%)	24 (23.8%)	54 (27.0%)
Perceived conflict about two topics	16 (16.2%)	13 (12.9%)	29 (14.5%)
Perceived conflict about three topics	14 (14.1%)	6 (5.9%)	20 (10.0%)
Perceived conflict about four topics	4 (4.0%)	2 (2.0%)	6 (3.0%)
Total	99	101	200

Exposure to contradictory headlines elicited more responses with perceived conflict compared to exposure to contradictory briefs. The percentage of respondents who perceived conflict varied across health topics. Specifically, for the news headlines condition, 50.5% participants perceived conflict after reading the headlines about nutrition[5], 19.2% perceived conflict for the topic of e-cigarettes, 23.2% for mammography, and 28.3% for PSA testing. For the news briefs condition, 19.8% of respondents who read the briefs about moderate drinking perceived conflict, 12.9% for the topic of e-cigarettes, 20.8% for mammography, and 21.8% for PSA testing.

[5] A significantly larger proportion of respondents perceived conflict after reading contradictory news headlines about nutrition. I speculate the reason was that headlines about nutrition included contradictory messages about moderate drinking, fish consumption, organic milk, and coffee consumption. Some may argue these were actually four health topics within nutrition. Thus, respondents may think a larger volume of conflicting information about nutrition exists compared to other groups of conflicting messages about which that is essentially a single topic.

To better assess the extent to which participants recognized conflict, I also used close-ended measures to capture perceived conflict. Specifically, participants were asked: "Think back to the health news messages that you read earlier. On a scale from 0 to 100, how much conflicting information did you notice in the messages you read? Zero (0) indicates no conflicting information and one hundred (100) indicates a lot of conflicting information" (M = 80.19, SD = 21.91). In addition to this sliding scale, participants also responded to two statements on a scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*): "The health news messages were contradictory" (M = 4.28, SD = .89) and "The health news messages were inconsistent" (M = 4.19, SD = .94). Although a reference, control condition of no exposure to conflict was not included in the study, it is evident that level of perceived conflict was relatively high—well above the midpoint—across three items. Consistent with the patterns of thought-listing responses, there is some evidence that participants in the headlines condition reported a greater level of perceived conflict than those in the briefs condition (Table 1.2). There are two potential explanations for this finding. First, for each topic within the headlines condition, there were several pairs of conflicting messages; while for each topic within the briefs condition, there was only one pair of messages (see Appendix A for details). Thus, it is conceivable that the headlines condition was perceived to contain a larger volume of contradictory messages than the briefs condition, which in turn generated a greater level of perceived conflict. Second, more contextual information (e.g., samples used in studies) was provided in the briefs condition, which may facilitate respondents reconciling perceived conflict. They may realize that contradictory findings

can be caused by different samples and methods, therefore, report a relatively lower level of perceived conflict.

Table 1.2 *Differences in perceived conflict by condition*

	Headlines condition *Mean* (*SD*)	Briefs condition *Mean* (*SD*)	F-score (p-value)
How much conflicting information did you notice in the messages?	83.51 (19.98)	77.92 (23.52)	2.20 (.139)
The health news messages were contradictory.	4.41 (.74)	4.15 (1.00)	4.51 (.035)
The health news messages were inconsistent.	4.31 (.85)	4.08 (1.01)	3.14 (.078)

Based on responses to thought-listing tasks and closed-ended questions, I concluded that exposure to contradictory health messages indeed was linked to perceived conflict. On top of perceived conflict, I also looked for participants' cognitive and affective outcomes of exposure to conflict (e.g., confusion, ambivalence, backlash, anger, fear), especially those that have not been examined in prior research. Table 1.3 below summarizes some outcomes that emerged in participants' responses. It is worth noting that it is not common for participants to express their feelings very explicitly but a few participants said they were surprised by contradictory health messages. Another outcome that has been less examined in prior research but which was identified in thought-listing responses was media skepticism. Some participants questioned how credible news media were after reading conflicting news headlines or briefs. Therefore,

surprise and media skepticism were also included in the main study of this dissertation along with affective responses of fear and anger and cognitive responses of confusion, ambivalence, and backlash.

Table 1.3 *Examples of outcomes emerged in thought-listing responses*

Outcomes	Examples
Confusion	"I am again questioning which advice is best." "There are conflicting ideas and now I'm really confused."
Media skepticism	"Can any news be relied on anymore?" "The media is making misleading titles to distract people or for fear mongering or something."
Backlash	"I'm thinking that scientists are confused and conflicting themselves with their findings."
Surprise	"I'm surprised at the conflicting opinions on the effectiveness of screening. I never would have thought about the consequences of screening."

Taken together, this dissertation examines the roles of perceived conflict and self-relevance in contradictory health information processing. Before moving forward, it is worth pointing out that although this dissertation focuses on the so-called adverse outcomes of exposure to contradictory health messages, such exposure does not always impede healthy behaviors. Under certain circumstances, knowing both positive and negative sides could actually help people to make an informed decision. For example, for health domains where ambiguity currently exists over recommended behaviors (e.g., mammography, PSA testing, genetic screening), contradictory exposure and its subsequent perceived conflict may overall be more positive than negative. To be more specific, while mammography may detect breast cancer at an earlier stage and save lives,

it may also cause potential harms such as overdiagnosis and overtreatment (Harris et al., 2013). So, it is particularly important for younger women who are at average risk to weigh both benefits and harms in deciding when to initiate screening and what the frequency is. In this case, receiving contradictory information may be desirable for these women insofar as such information may prompt them to weigh the possibilities of benefits and harms, talk to their physicians, and ultimately make an informed decision. Using longitudinal survey data and lagged analyses, Gibson et al. (2016) found that amid conflicting recommendations about PSA tests, among men with a recent PSA test, active information seeking was associated with reduced odds of later having a PSA test. They speculated that the public communication environment rife with contradictory information may increase men's perceived ambiguity about PSA testing, which, in turn, reduced their motivation to repeat screening over time. Given that potential harms may outweigh benefits of routine PSA tests, this finding of a lower level of participation in screening may be considered a normatively "good" outcome.

However, for health domains where scientific evidence is consistent and conclusive, exposure to contradictory health information may indeed lead to deleterious health outcomes. For example, Dixon and Clarke (2013) studied the effects of exposure to falsely balanced reporting on the autism–vaccination link. Results revealed that participants who were exposed to a news article presenting information both for and against the link reported less certainty about vaccine safety, less certainty in scientists' view on vaccine safety, and lower intentions to have their children vaccinated. Note that the so-called "adverse" outcomes of exposure to contradictory health messages may be

less of a concern for this dissertation, as all tested health topics were relatively less controversial compared to the topics of cancer screening or vaccination.

CHAPTER 2: MODEL OF EFFECTS AND RESEARCH OVERVIEW

Conceptual model of effects

Figure 2.1 presents the dissertation's conceptual model of effects. In particular, I propose perceived conflict as a potential mediator between contradictory messages exposure and its subsequent cognitive and affective outcomes, such as confusion, ambivalence, backlash, media skepticism, anger, fear, and surprise. Also, defensive processing—indicated by message derogation and counterarguing—may occur for those who are highly self-relevant to contradictory messages.

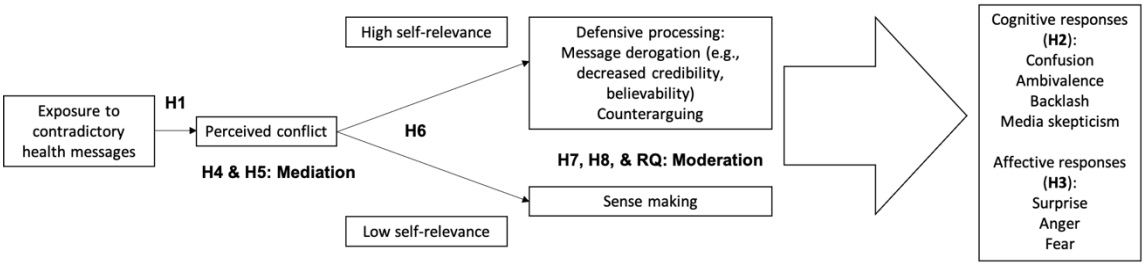


Figure 2.1 Conceptual model of effects

Note that here ambivalence is defined as a topic-specific outcome but confusion is defined as both a topic-specific and more general outcome. For example, after exposure to contradictory information about mammography, women may have mammography-specific confusion; they may also have similar responses toward cancer prevention and research in general (e.g., have concerns about other types of cancer screening). After contradictory information exposure to a particular health topic, people may have more general cognitive and behavioral intentional responses to other health-

related domains, in which contradictory information may not exist (or exist to a much lesser extent). This phenomenon has been described as "carryover" or "spillover" effects (Nagler & LoRusso, 2018). Given the definitions of backlash and media skepticism, these could be considered markers of carryover effects. So, this dissertation examined both topic-specific and more general (carryover) cognitive responses to topic-specific contradictory messages.

Affect is an umbrella term that encompasses all sorts of feelings (Dillard & Seo, 2013). The current study focuses on discrete emotions, particularly negative ones (i.e., anger, fear) (Shaver et al., 1987). Other negative emotions, such as frustration, annoyance, and distress, have been examined as responses to contradictory health information (e.g., Nagler et al., 2019). However, these are normally considered under basic emotions (e.g., Shaver et al., 1987) and measured as part of these basic emotions (e.g., Nabi & Prestin, 2016; Nabi et al., 2006). Specifically, frustration and annoyance can be grouped into the basic emotion category of anger; distress can belong to fear (Shaver et al., 1987). Although surprise may not be a negative emotion, it is also included in the study as it was mentioned by respondents in the exploratory thought-listing study.

Specific hypotheses are as follows:

H1*: Compared with one-sided, consistent messages, exposure to contradictory health messages will be significantly associated with greater perceived conflict.*

H2*: Perceived conflict will be significantly associated with greater cognitive responses; specifically, topic-specific confusion (H2a), more general confusion (H2b), ambivalence (H2c), backlash (H2d), and media skepticism (H2e).*

H3*: Perceived conflict will be significantly associated with greater affective responses to the messages they read; specifically, anger (H3a), fear (H3b), and surprise (H3c).*

H4*: Cognitive effects of exposure to contradictory health messages will be mediated by perceived conflict.*

H5*: Affective effects of exposure to contradictory health messages will be mediated by perceived conflict.*

As discussed in the literature review, self-relevance may prompt differential information processing routes. When encountering contradictory messages about a health topic (e.g., one about health benefits and the other about health risks of performing a particular behavior), higher self-relevance individuals are more likely to have defensive reactions toward the dissonant message (i.e., health risks message) than the consonant message (i.e., health benefits message) because such a dissonant message challenges their positive self-concept as a healthy person. In contrast, lower self-relevance individuals may have similar responses to both messages. Therefore, I propose:

H6*: Higher self-relevance individuals will report greater message derogation and counterarguing toward the dissonant message (H6a); lower self-relevance individuals will report the same level of message derogation and counterarguing toward both messages (H6b).*

Through defensive processing, higher self-relevance individuals may dismiss the dissonant message that threatens their self-concept. As a result, they may report less topic-specific confusion and ambivalence. It is worth noting that the moderating effects of self-concept may vary between topic-specific cognitive responses (i.e., topic-specific

confusion and ambivalence) and more general carryover effects (i.e., general confusion, backlash, and media skepticism). As explained above, defensive processing cued by self-relevance may help resolve topic-specific confusion and ambivalence to some extent because when evaluating topic-specific contradictory messages, people may weigh consistent messages (i.e., messages that are consistent with their prior beliefs) more than dissonant ones (i.e., messages that are dissonant with their prior beliefs). However, when the object to be evaluated becomes more general (e.g., health research or news media), people might realize that there is both more credible (i.e., consistent messages) and less credible (i.e., dissonant messages) information. So, they may be both positively and negatively influenced, resulting in no change in attitudes toward health research and news media in general. Therefore, the current study only focuses on the moderating effects of self-relevance on the topic-specific cognitive outcomes:

H7*: Self-relevance will moderate the perceived conflict–topic-specific confusion (H7a) and perceived conflict–ambivalence (H7b) relations; the adverse effects will be more pronounced among lower-relevance individuals.*

Furthermore, according to appraisal theory, when an individual recognizes the dissonance that violates his/her goal as an intelligent or healthy person, negative emotions may arise (Dillard & Seo, 2013). Since higher-relevance individuals may have a stronger perception of such incongruence, they tend to generate more intense negative emotional experiences (i.e., fear, anger) (Dillard & Nabi, 2006). Therefore, H8 is offered to examine the moderating effects of self-relevance on the perceived conflict–negative emotional responses relation. As surprise may not be a negative emotion and has been

overlooked in prior research, little is known about whether we can expect moderating effects here; thus a research question instead of a hypothesis is provided.

H8*: Self-relevance will moderate the perceived conflict–anger (H8a) and perceived conflict–fear (H8b) relations; the adverse effects will be more pronounced among higher-relevance individuals.*

RQ*: Will self-relevance moderate the perceived conflict–surprise relation?*

Taken together, H1-5 are concerned with the potential mediating effects of perceived conflict and H6-8 & RQ focus on the potential moderating effects of self-relevance. To test these hypotheses and answer the research question, a two-wave study was conducted.

Overview of research studies

Different approaches to mediation

Given the centrality of mediation in this dissertation, before delving into the study details, it is worth briefly reviewing the current approaches to testing mediation. As noted in prior work, it is useful to consider two models when thinking about mediation: One is the theoretical model, which contains unobservable relations among variables, and the other is the empirical model, which relies on statistical analyses of actual data (MacKinnon et al., 2007; MacKinnon & Pirlott, 2015). Thus, the challenge becomes how to infer the true mediation from observation.

Experiments are commonly used to establish causal relationships. In typical experimental studies, participants are randomly assigned to different levels of the independent variable; the mediating and dependent variables are then measured and

statistical analyses assessing mediation are performed (referred to as *measurement-of-mediator* in Pirlott & MacKinnon, 2016). However, participants are not actually randomly assigned to different levels of mediators. Merely measuring M and Y only allows the assessment of covariation between the two, which does not attest to the temporal precedence of M to Y or eliminate alternative confounding variables that may influence both M and Y (Pirlott & MacKinnon, 2016). Under certain circumstances, even if there was no statistically significant association between X and Y, mediation might still exist (Rucker et al., 2011). For example, total effect from X to Y is the sum of many potential paths of indirect effects; there might be another mediator that is not of primary research interest that operates in opposite direction than M included in the model (Hayes, 2009). Thus, with *measurement-of-mediator* approach, researchers can only demonstrate that the M–DV relationship is correlational rather than causal.

Alternatively, some experimental work has manipulated both the independent and mediating variables, which provides stronger causal claims for the M–DV relationship (referred to as *manipulation-of-mediator* in Pirlott & MacKinnon, 2016). Such designs focus on elucidating the theoretical arguments rather than making a decision on the type of statistical analyses (Spencer et al., 2005). For example, in experiment 1, participants are randomly assigned to different levels of IV, and M is measured to allow statistical inference for the IV to M path; in experiment 2, participants then are randomly assigned to different levels of M* (defined as how IV influences M in experiment 1), and DV is measured to allow estimation of the M to DV path. If results showed that IV significantly changed M in experiment 1 and M significantly influenced

DV in experiment 2, then there would be evidence supporting mediation (MacKinnon et al., 2007; Pirlott & MacKinnon, 2016).

I argue that after exposure to contradictory health messages people (X) may infer conflict and this perceived conflict (M) may lead to subsequent outcomes (Y). Adopting the *manipulation-of-mediator* approach, this dissertation tested the IV–M causal relationship in one study and M–DV causal relationship in another study. If both relationships are statistically significant, then it is very likely that mediation holds.

Study design: A two-wave survey experiment

To test the potential moderating effects of self-relevance, it is important to choose the appropriate health topic which allows variances in the level of self-relevance. As explained in the literature review, to fully capture the concept of self-relevance, it is necessary to survey both one's prior behavior and perceived relevance of the given health topic. Relatively high self-relevance individuals are those who are committed to the health behavior and, more importantly, perceive the behavior as part of their identity. Conversely, low self-relevance individuals are those who are not committed to the behavior or those who are committed but do not consider the behavior as important to themselves. Therefore, it is critical to select a health issue for which individuals with multiple levels of self-relevance are approximately equally distributed.

With this in mind, I conducted a two-wave survey experiment with the same group of respondents: Wave 1 aimed to select the appropriate health context and Wave 2 aimed to test proposed model of effects (see Figure 2.2 Study design).

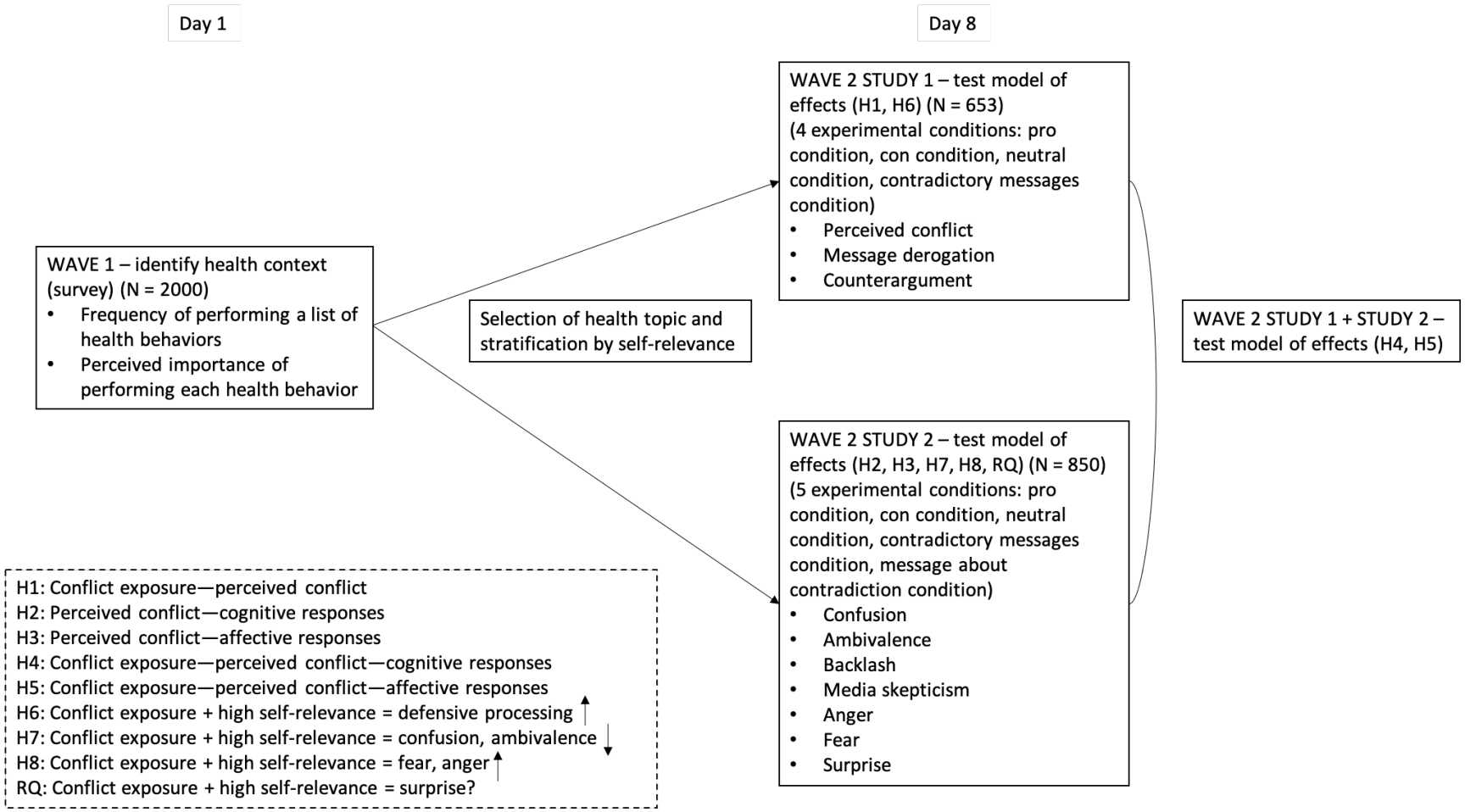


Figure 2.2 Study design

This design enabled me to eliminate the potential threat of distinct self-relevance distributions with different samples between Wave 1 and Wave 2. While Wave 1 was a single survey, Wave 2 included two experiments. This study was conducted on the online research platform Prolific Academic (ProA), which offers similar capabilities of Amazon Mechanical Turk (MTurk), but may provide better data quality. There is evidence that participants on ProA are more diverse, responsive, and naïve compared with "professional survey-takers" on MTurk (Palan & Schitter, 2018; Peer et al., 2017).

Specifically, Wave 1 recruited 2,000 participants[6] on ProA, who were asked to report how frequently they perform eight health behaviors as well as their perceived importance of performing each health behavior. Based on their responses, I selected the health topic of coffee consumption for which respondents with varying level of self-relevance were most equally distributed. Also, participants were stratified into higher self-relevance, medium self-relevance, and lower self-relevance groups for Wave 2. Within each subgroup, they were randomly assigned to an experimental condition. Approximately one week after Wave 1, participants were contacted again on ProA. In total, 1,503 participants completed Wave 2 studies[7]: Study 1 (testing IV–M relationship)

[6] Due to the limited evidence on the effect size and uncertainty regarding the health context prior to Wave 1, it might be safer to assume a small (i.e., $f = 0.1$) to medium (i.e., $f = 0.25$) effect size in order to have sufficient statistical power to detect main and interaction effects. Using G*Power 3.1, I calculated the sample size needed. With a small effect, the sample size needed for Wave 2 is about 1,500; with a medium effect, the sample size needed is about 250. Given the possible attrition from Wave 1 to Wave 2, I recruited 2,000 participants at Wave 1. Attrition rate is estimated as 25% based on evidence from previous panel studies (e.g., Christenson & Glick, 2013). For example, the response rates for a four-wave MTurk study were 76% at Wave 2, 91% at Wave 3, and 88% at Wave 4. Attrition is less likely for crowdsourcing platforms because participants are easy to contact through their accounts.

[7] Given that the procedures were almost identical in Study 1 and Study 2 (same pre-test measures, one additional experimental condition in Study 2, different post-test measures), to reduce study costs and logistical burden I conducted both studies concurrently at Wave 2. Note that Study 1 and Study 2 were conducted concurrently but analyzed separately.

participants responded to questions assessing perceived conflict and defensive processing, while Study 2 (testing M–DV relationship) participants answered questions assessing cognitive and affective responses. This design ensured that the self-relevance distribution did not change significantly across waves and participants who completed Study 1 would not participate in Study 2 or vice versa.

Stimuli development and pretest

Due to the tight timeline between Wave 1 and Wave 2, stimuli materials for all eight candidate health contexts had been developed and pretested prior to Wave 1. In a content analysis, Nagler (2010) identified some nutrition topics that contain contradictory information in the news media (Nagler, 2010). These topics included red wine or other alcohol, fish, coffee, vitamins/supplements, soy, fat, eggs, sugar, red meat, fiber, salt, and chocolate. Other health topics discussed in an encyclopedia entry on conflicting information in health messaging (Nagler & LoRusso, 2018) included HPV vaccine, tofu, milk, running, mammography, PSA testing, vaccines and autism, and medication. Based on this list of health topics, eight routine health behaviors—drinking coffee, eating fish, taking vitamins/supplements, eating chocolate, eating organic foods, eating low-carbohydrate foods, having high-intensity exercise, and eating eggs—were selected as candidates for the health context to avoid the restrictions on recruitment. For each health topic, five stimuli messages were developed based on real news stories (see Appendix C for examples of stimuli messages).

Note that there were four conditions in Wave 2 Study 1—three one-sided, consistent message conditions as comparison groups (comparison 1: pros/benefits about coffee consumption; comparison 2: cons/risks about coffee consumption; comparison 3:

neutral/general information about coffee) and a contradictory messages condition (one pros/benefits message and one cons/risks message about coffee consumption). To better explicate the relationships between perceived conflict and outcome variables (Wave 2 Study 2), it may be useful to add another level of perceived conflict. As explained in the literature review, it is easier for people to infer conflict after exposure to *messages about contradiction* than *contradictory messages*. Thus, theoretically, including a condition of *messages about contradiction*—compared to a condition of *contradictory messages* and comparison conditions—should produce greater levels of perceived conflict. With this purpose in mind, I added one more condition that represented messages about contradiction to Study 2, which highlighted conflict across study findings.

To ensure that the stimuli produced multiple levels of contradictory exposure and perceived conflict, I conducted a pilot study on CloudResearch (formerly TurkPrime). In total, 200 respondents completed the study and received $1.50 for their participation. The ages of respondents ranged from 20 to 70 (M = 37.43, SD = 11.52). A majority of respondents identified as white (82.3%) and had at least some college education (85.7%). Of all respondents, 60.6% were male. On average, respondents spent about 10 minutes on the study.

Respondents were randomly assigned to read 4 out of 40 stimulus materials (i.e., 5 conditions for each of the 8 health contexts). Following exposure to each stimulus material, respondents first were asked to rate the valence of the news story with the question, "Would you say the content of what you just saw was negative (discussed harmful effects), positive (beneficial effects), or a mix of both?" Response options included "completely negative," "mostly negative," "a mix of both," "mostly positive,"

"completely positive," and "neither negative nor positive (neutral)" (Tan et al., 2017). As expected, across health topics, news stories about beneficial effects were associated with more ratings of positive valence while news stories about harmful effects were associated with more ratings of negative valence. Also, contradictory messages and messages about contradiction resulted in more responses of "a mix of both."

Then respondents reported their perceptions of each news story. They were asked to indicate whether they think the content of what they just saw was: "contradictory," "inconsistent," "conflicting," "credible," and "believable." Response options ranged from 1 (*strongly disagree*) to 5 (*strongly agree*). For each stimulus material, the first three items were averaged to create a conflict scale and the last two items were averaged to create a credibility scale (see Appendix D for means of perceived conflict and credibility by condition and health topic). Again, in line with expectation, two exposure to conflict conditions (i.e., contradictory messages condition and messages about contradiction condition) elicited a greater level of perceived conflict compared to three comparison conditions without exposure to conflict. However, it is worth noting that contrary to my prediction, perceived conflict was even greater after exposure to contradictory messages than exposure to messages about contradiction. Given that perceived conflict was relatively high on a 5-point scale across health topics (range: 3.82 to 4.38, except 3.40 for vitamin consumption), it is difficult to create a higher level of conflict in messages about contradiction. Thus, no further modification to messages about contradiction was made; instead, they were included in main study as another condition of exposure to conflict alongside contradictory messages.

Additionally, all stimulus materials were rated as relatively credible since all means of perceived credibility were above the midpoint on a 5-point scale, except the news story about harmful effects of high-intensity exercise (M = 2.98). Given the widespread information about benefits of exercise, this finding was not a surprise. It would be difficult to counter a strong prior belief with exposure to a single news story. So, no edits were made to this specific news story.

Taken together, pilot study indicated that stimulus materials successfully created different levels of exposure to conflict. Also, they were generally perceived as credible. Once the health topic was determined via Wave 1 survey, corresponding stimulus materials of that specific topic were used in Wave 2 studies.

CHAPTER 3: WAVE 1—IDENTIFY HEALTH CONTEXT

Introduction

The goal of Wave 1 was to select a health topic for which individuals with multiple levels of self-relevance are approximately equally distributed. To fully capture self-relevance, it is important to assess both prior behavior and perceived importance of performing that behavior. So, Wave 1 was a simple survey about participants' self-relevance to eight routine health behaviors.

Method

Data collection

The survey was conducted in September 2020 with a sample of the general U.S. population. Participants self-selected to participate in the study through ProA. After consenting to participate, they were asked to report how frequently they perform some health behaviors, then rated how important it is to perform each behavior. Individual factors, such as demographic information and understanding of scientific research[8], were also assessed in Wave 1 (full questionnaire included in Appendix E). To link Wave 1 and Wave 2 responses, participants' ProA ID was also collected. Last, to minimize attrition at Wave 2, participants were reminded that a follow-up survey (i.e., Wave 2) would be sent out to them in about 7-10 days. Participants received a reward of $1.00 for completing Wave 1 survey.

[8] Understanding of scientific research was measured in Wave 1 for future research purpose that is not part of this dissertation.

Key measures

Self-relevance. To assess the frequency of behavior, a question adapted from National Health and Nutrition Examination Survey (NHANES, 2016) and Health Information National Trends Survey (HINTS, 2005) was asked (Table 3.1). The order of showing each health behavior was fully randomized.

Table 3.1 *Frequency measures of behavior performance*

Please look at a list of behaviors. During the past 30 days, how often did you perform the following behaviors?

	Never	Rarely (less than once a week)	Sometimes (1-2 times per week)	Often (3-5 times per week)	Every day (once a day or more)
Drinking coffee	◯	◯	◯	◯	◯
Eating fish	◯	◯	◯	◯	◯
Taking vitamins/ supplements	◯	◯	◯	◯	◯
Eating chocolate	◯	◯	◯	◯	◯
Eating organic foods	◯	◯	◯	◯	◯
Doing high-intensity physical activity or exercise[9]	◯	◯	◯	◯	◯
Eating low-carbohydrate (low-carb) foods	◯	◯	◯	◯	◯
Eating eggs	◯	◯	◯	◯	◯

[9] The complete wording for this item was "Doing high-intensity physical activity or exercise that causes heavy sweating or large increases in breathing or heart rate (some examples are running, lap swimming, aerobics classes or fast bicycling)."

Then participants rated perceived relevance of performing each behavior on five 7-point bipolar scales, borrowed from Zaichkowsky's personal involvement inventory (1994) (Table 3.2). Again, the order of showing each health behavior was randomized. This measure demonstrated strong internal consistency—Cronbach's α ranged from .91 to .97 across eight health topics. For each behavior, items were averaged to create a perceived relevance scale.

Table 3.2 *Measures of perceived importance of each health behavior*

To me, [*insert a particular health behavior*]:

Means nothing	◯	◯	◯	◯	◯	◯	◯	Means a lot
Is unimportant	◯	◯	◯	◯	◯	◯	◯	Is important
Is worthless	◯	◯	◯	◯	◯	◯	◯	Is valuable
Is unnecessary	◯	◯	◯	◯	◯	◯	◯	Is necessary
Is irrelevant	◯	◯	◯	◯	◯	◯	◯	Is relevant

Analytic approach

For each health behavior, descriptive analyses of behavior frequency and perceived relevance were performed. Table 3.3 presents the distribution of behavior frequency by health topic, based on which respondents were categorized into three groups—those having a weak, medium, and strong prior. Specifically, those who selected "Never" and "Rarely" were categorized as having a weak prior (coded as "1"); those who selected "Sometimes" were categorized as having a medium prior (coded as "2"); those who selected "Often" and "Every day" were categorized as having a strong prior (coded as "3").

Table 3.3 *Distribution of behavior frequency by health topic (N = 1944)*

	Never	Rarely	Sometimes	Often	Every day
Drinking coffee	580 (29.8%)	248 (12.8%)	195 (10.0%)	239 (12.3%)	682 (35.1%)
Eating fish	475 (24.4%)	644 (33.1%)	619 (31.8%)	181 (9.3%)	25 (1.3%)
Taking vitamins/ supplements	491 (25.3%)	289 (14.9%)	227 (11.7%)	292 (15.0%)	645 (33.2%)
Eating chocolate	170 (8.7%)	701 (36.1%)	623 (32.0%)	373 (19.2%)	77 (4.0%)
Eating organic foods	260 (13.4%)	506 (26.0%)	606 (31.2%)	425 (21.9%)	147 (7.6%)
Doing high-intensity exercise	379 (19.5%)	537 (27.6%)	486 (25.0%)	434 (22.3%)	108 (5.6%)
Eating low-carb foods	189 (9.7%)	462 (23.8%)	762 (39.2%)	382 (19.7%)	149 (7.7%)
Eating eggs	178 (9.2%)	407 (20.9%)	705 (36.3%)	501 (25.8%)	153 (7.9%)

Table 3.4 shows details about perceived relevance scales by health topic. Similar to behavior frequency, perceived relevance was recoded into three categories: those who had a score larger than 1 and smaller than 3 were categorized as having a lower perceived relevance and recoded as “1”; those who had a score between 3 and 5 were categorized as having a medium perceived relevance and recoded as “2”; those who had a score larger than 5 and smaller than 7 were categorized as having a higher perceived relevance and recoded as “3.”

Table 3.4 *Perceived relevance scales by health topic (N = 1944)*

	Perceived relevance scales
Drinking coffee	Range = 1.00-7.00, *M* = 3.98 (*SD* = 2.11)
Eating fish	Range = 1.00-7.00, *M* = 4.36 (*SD* = 1.72)
Taking vitamins/ supplements	Range = 1.00-7.00, *M* = 4.99 (*SD* = 1.73)
Eating chocolate	Range = 1.00-7.00, *M* = 3.83 (*SD* = 1.56)
Eating organic foods	Range = 1.00-7.00, *M* = 4.41 (*SD* = 1.73)
Doing high-intensity exercise	Range = 1.00-7.00, *M* = 5.76 (*SD* = 1.22)
Eating low-carb foods	Range = 1.00-7.00, *M* = 4.39 (*SD* = 1.62)
Eating eggs	Range = 1.00-7.00, *M* = 4.56 (*SD* = 1.51)

For each health behavior, a self-relevance score was calculated based on responses to frequency of behavior and perceived relevance of that behavior. Specifically, the recoded values of frequency of behavior and perceived relevance were multiplied together; both weighed 50% in the final self-relevance score. Below the table shows the possible nine scenarios for the self-relevance score. A higher score indicates a higher level of self-relevance. Accordingly, for each health topic, there were lower self-relevance individuals, medium self-relevance individuals, and higher self-relevance individuals. The health topic with the best uniform distribution of self-relevance levels (i.e., similar number of individuals within each subgroup) was selected as the context for Wave 2.

	Frequency of behavior			
Perceived relevance	*Recoded value*	1	2	3
	1	1 (low)	2 (low)	3 (medium)
	2	2 (low)	4 (medium)	6 (high)
	3	3 (medium)	6 (high)	9 (high)

Results

Sample characteristics

A total of 2000 responses were collected in Wave 1. After removing partial responses and duplicate responses from the same ProA ID, 1944 responses were included in Wave 1 analysis. The ages of participants ranged from 18 to 78 years with an average age of 32.47 (*SD* = 11.95) and about half of the sample was male (49.3%). Less than 1% of participants had less than a high school degree, 12.0% had 12 years education or completed high school, 23.7% had some college education, and 52.7% had a Bachelor's degree or higher. A majority of participants identified themselves as White (65.0%), 6.5% identified as Black or African American, 13.1% identified as Asian, and the remainder identified as other or multiple races (15.3%). Full sample characteristics are provided in Appendix F.

Health topic selection

Distribution of self-relevance for each health topic is presented in Figure 3.1. The topic of drinking coffee clearly had the best uniform distribution of self-relevance levels, with 659 low self-relevance individuals (33.9%), 585 medium self-relevance individuals (30.1%), and 700 high self-relevance individuals (36.0%). Additionally, compared with other health topics, the correlation between behavior frequency and perceived importance was highest for coffee consumption (Pearson's r = .84). Therefore, coffee consumption was selected as the health topic for Wave 2 study.

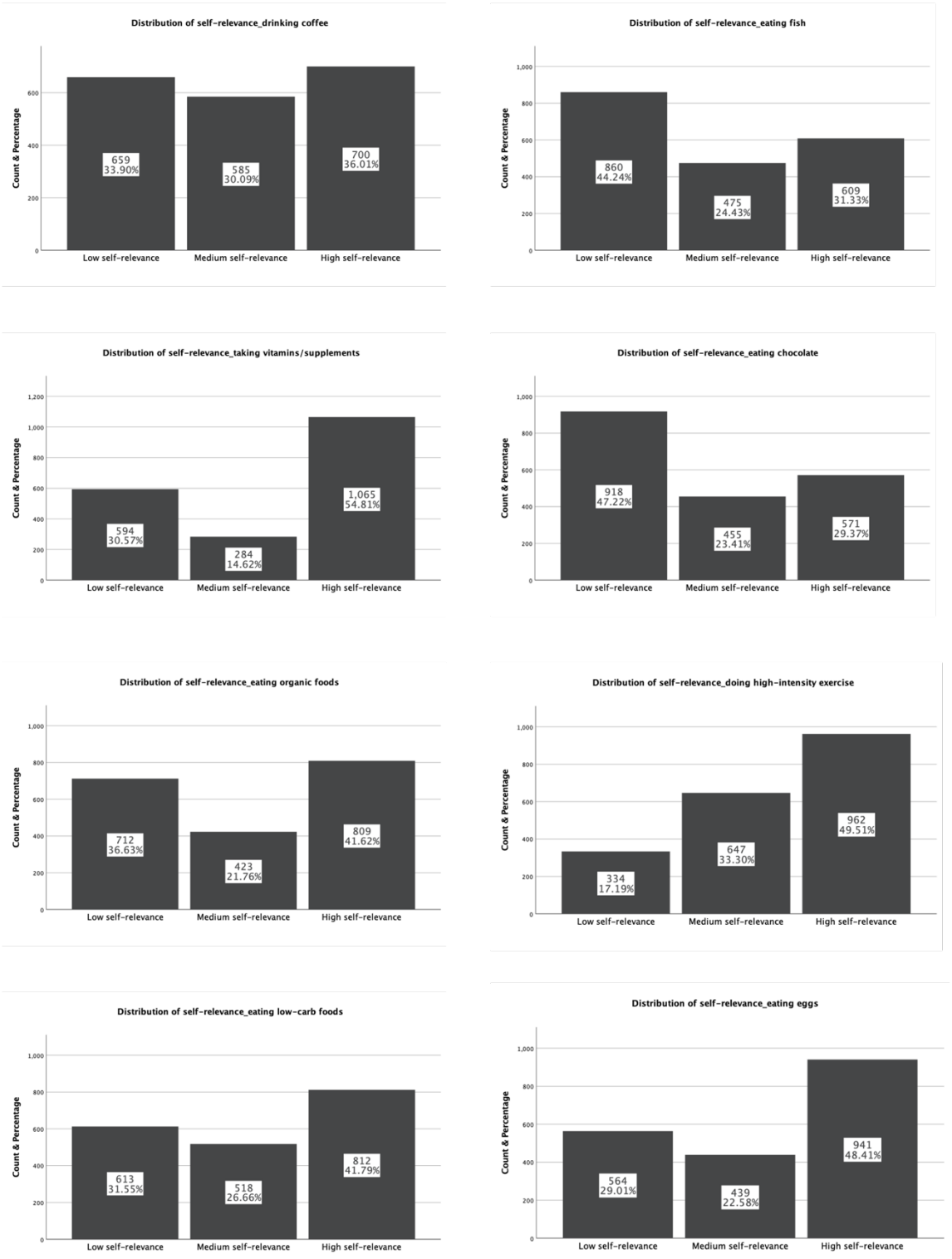


Figure 3.1 Distribution of self-relevance by health topic

Discussion

As the selection of health context for Wave 2 was mainly based on calculated self-relevance scores, it is important to note two methodological issues about this approach. First, while the same cutoff frequency was used to categorize individuals into groups of having weak, medium, and strong priors across eight health topics (i.e., "Never" and "Rarely" as having a weak prior; "Sometimes" as having a medium prior; "Often" and "Every day" as having a strong prior), there might be different ways to create these subcategories depending on how people naturally perform a health behavior. For example, it is likely that a lot of people take vitamins daily; thus, "Often" may not entirely fit the concept of commitment. Those who selected "Often" could be categorized into the medium prior group instead of the strong prior group. Second, although it is important to take both factors—behavior frequency (i.e., behaviors) and perceived relevance (i.e., perceptions)—into consideration when measuring self-relevance, they may not always covary for certain health topics. For instance, doing high-intensity exercise was generally considered important and valuable (perceived relevance of 5.76 on a 7-point scale) but only 27.9% of participants engaged in such activities often or daily. Maybe varying weights can be assigned to the two factors when calculating self-relevance scores. Future research should continue exploring how best to capture self-relevance.

CHAPTER 4: WAVE 2—TEST MODEL OF EFFECTS

Introduction

The overarching goal of Wave 2 experimental studies was to test the proposed model of effects (Figure 2.1). To be specific, Wave 2 Study 1 examined whether people would perceive conflict after contradictory information exposure (H1), as well as whether self-relevance would prompt defensive processing of the dissonant message that may challenge self-concept by including information about potential health risks of performing a committed behavior (H6). In Study 1, the independent variable was the message exposure condition and the key outcome variable was perceived conflict. Wave 2 Study 2 focused on perceived conflict–cognition relationships (H2), perceived conflict–emotion relationships (H3), and the moderating effects of self-relevance on these relationships (H7, H8, and RQ). So, in Study 2, the independent variable was perceived conflict, and the message exposure was used to elicit different levels of perceived conflict. Taken both studies together, the mediating role of perceived conflict was assessed based on whether H1 as well as H2 and H3 were supported.

Wave 2 was launched after one week following the closure of Wave 1 survey. As explained in Chapter 2, Study 1 and Study 2 were conducted concurrently but analyzed separately. A total of 1944 participants—who were included in Wave 1 analysis—were contacted again and asked to participate in Wave 2. Stratification was needed to ensure that participants within each self-relevance group were equally distributed across stimulus conditions. Through Qualtrics programming, stratification was performed based on an individual's calculated self-relevance score collected at Wave 1. Within

each subgroup, participants were randomly assigned to an experimental condition and asked to read a news story or two contradictory news stories. Participants received a reward of $1.50 for completing either Wave 2 study.

Wave 2 Study 1

Method

Procedure

After consenting to participate, participants were randomly assigned to one of four conditions—three comparison conditions and one contradictory messages condition—that resembled real news stories about coffee consumption. Specifically, three one-sided comparison stimulus messages discussed the potential health benefits of coffee consumption (e.g., "new study suggests drinking coffee tied to lower risk of death) (comparison group 1), potential risks of coffee consumption (e.g., "heavy coffee consumption linked to higher death risk") (comparison group 2), and general information about coffee (e.g., "scientists create beanless coffee without the bitterness") (comparison group 3), respectively. The exposure to contradictory messages condition included two distinct, contradictory news stories—one about the potential benefits and one about the potential risks of coffee consumption—which were the same messages used in the comparison condition 1 and 2. The order of seeing contradictory news stories was fully randomized. It is worth noting that aside from comparison group 3, the operationalization of exposure versus no exposure to conflict was informed by the idea of divergent versus convergent news coverage (Jensen & Hurley, 2012). Divergence occurs when different sources provide contradictory information whereas convergence

was when different sources provide consistent or overlapping messages. In the current study, convergence was created by including findings from a scientific study about coffee consumption and quotes from a scientist who supported such findings, but was not involved in the study, within a single news story; divergence was created by presenting contradictory research findings from distinct studies about coffee consumption in two separate news stories.

Following stimulus exposure, participants answered post-test questions assessing perceived conflict and defensive processing (indicated by the level of message derogation and counterarguing). Last, a manipulation check question examining participants' understanding of stimulus was presented. Note that participants in the contradictory information exposure condition received a different post-test measures module than other participants. Because they had been exposed to two news stories, when responding to post-test questions, they were asked about their opinions regarding the two news stories instead of a single news story.

Measures

Perceived conflict[10]. To measure perceived conflict, participants were asked to indicate whether they agreed or disagreed with three statements adapted from Chang

[10] In addition to the measure reported here, another three different measures were used to capture perceived conflict but not analyzed in this dissertation. First, a thought-listing question was presented right after the message exposure: "We're now interested in what you were thinking about when you were reading the news story. Please use the text box below to record your thoughts and ideas. You should try to record only those ideas that you were thinking when reading the news story. Don't worry about spelling and grammar. Please be completely honest and list all of the thoughts that you had." The second measure was adapted from Nagler and colleagues (2019), which included two sliding scales: 1) "Think back to the news story that you read earlier. On a scale from 0 to 100, how much discussion about health information that always seems to be changing did you notice in the news story you read? Zero (0) indicates no information that always seems to be changing and one hundred (100) indicates a lot of information that always seems to be changing;" and 2) "Think back to the news story that you read earlier. On a scale from 0 to 100, to what degree you think the study findings discussed in the story contradict one another? Zero

(2015): “The content is contradictory,” “The content is inconsistent,” and “The content is conflicting” on a 5-point scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Items were averaged to create a perceived conflict scale (range = 1.00 – 5.00, M = 2.69, SD = 1.18), which demonstrated strong internal consistency (Cronbach’s α = .94).

Defensive processing. Defensive processing was indicated by counterarguing and message derogation. Given that exposure to contradictory messages condition contained two news stories, participants evaluated each news story separately and news headlines were presented to help participants recall the story. Counterarguing was measured by asking participants three questions adapted from Silvia (2006): “While reading the message, were you thinking of points that went against the argument?”; “While reading the message, were you feeling skeptical of the argument?”; and “Were you criticizing the message while you were reading it?” Response options ranged from 1 (*not at all*) to 5 (*very much*). Items were averaged to form a counterarguing scale for each news story (range = 1.00 – 5.00; M = 2.92, SD = 1.20 in three comparison conditions; M = 3.16, SD = 1.04 for the pro message and M = 3.11, SD = 1.07 for the con message in the contradictory messages condition), which demonstrated good internal consistency (Cronbach’s α = .86 in three comparison conditions; Cronbach’s α = .82 for the pro

(0) indicates you think no study findings contradict one another and one hundred (100) indicates you think a lot of study findings contradict one another.” Last, I added four items adapted from responses collected in the exploratory thought-listing study described in Chapter 1. Specifically, participants provided their opinion on each of the following statements: “I noticed that study findings were in opposition,” “Scientists always disagree with each other,” “It seems that research studies reach similar conclusions,” and “Experts claim conflicting opinions from time to time.” Response options ranged from 1 (*strongly disagree*) to 5 (*strongly agree*). Full questionnaire is included in Appendix G. To the best of my knowledge, there is no validated measure of perceived conflict. Therefore, I proposed four different promising measures. My future research will assess different types of validity (e.g., face validity, convergent validity, divergent validity) of these measures.

story and Cronbach's α = .85 for the con story in the contradictory messages condition). Message derogation measures were adapted from Witte (1994) and were used in previous research on defensive processing (e.g., Zhao & Nan, 2010). Participants indicated the extent to which they thought "The information in the message was 'exaggerated,' 'distorted,' 'overstated,' and 'overblown" ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Items were averaged to create a derogation scale for each news story (range = 1.00 – 5.00; M = 2.70, SD = .90 in three comparison conditions; M = 2.96, SD = .88 for the pro story and M = 3.09, SD = .93 for the con story in the contradictory messages condition), which showed strong internal consistency (Cronbach's α = .90 in three comparison conditions; Cronbach's α = .89 for the pro story and Cronbach's α = .92 for the con story in the contradictory messages condition).

Manipulation check. At the end of the experiment, participants were asked one question designed to serve as manipulation check: "Think back to the news story (stories) you read earlier. Would you say the news story (stories) was (were) negative, positive, or a mix of both?" This item was adapted from Tan et al. (2017) to assess participants' perceived valence of the message(s) after exposure to contradictory health information. Responses included "completely negative," "mostly negative," "a mix of both," "mostly positive," and "completely positive" ranging from 1 to 5 (M = 3.33, SD = 1.05). Manipulation would be considered successful if the mean of perceived valence was greater in the contradictory messages condition than that in the cons/risks condition (comparison condition 2) but smaller than that in the pros/benefits condition (comparison condition 1). Since comparison condition 3 story mentioned potentially

positive environmental impact brought by beanless coffee, perceived valence of this story should also be rated as relatively more positive.

Analytic approach

First, descriptive analyses were performed to understand data distribution of key variables. Then a one-way ANOVA test was used to examine whether participants' perceived valence of stimulus materials was in the expected direction. Next, to determine whether exposure to contradictory message elicited greater perceived conflict (H1), a one-way ANOVA was performed to compare means by experimental condition. Finally, to address whether defensive processing of dissonant message occurred among higher self-relevance individuals (H6), one-way ANOVA tests were used to compare means of message derogation and counterarguing toward each news story by self-relevance. All analyses were performed using SPSS Statistics version 27.

Results

Sample characteristics

A total of 653 participants completed Wave 2 Study 1[11]. After removing responses from four participants who failed attention check, 649 responses were included in analysis. The ages of participants ranged from 18 to 76 years with an average age of 33.29 (*SD* = 12.24) and just over half of the sample was male (50.7%). While more than 50% of participants had a Bachelor's degree or higher (54.8%), 12.5% had completed high school or less than high school education. A majority of participants

[11] Due to budget constraints, I had pre-determined the sample size of Wave 2 to be about 1,500 and Wave 1 to be 2,000 based on an estimated retention rate of 75%. Without budget constraints, more participants could have completed the Wave 2 studies and thus the actual retention rate could have been higher.

identified themselves as White (66.9%), 5.9% identified as Black or African American, 14.8% identified as Asian, and the remainder identified as other or multiple races (12.6%). Full sample characteristics are provided in Appendix H.

Randomization to experimental condition was successful, as there were no significant differences across conditions in age, gender, education, race/ethnicity, and self-relevance level (by design) (all *p*s > .15).

Manipulation check

Consistent with expectation, participants in pros/benefits comparison condition and neutral/general information comparison condition perceived news stories as more positive (pros/benefits condition: M = 4.15, 95% CI = 4.04 to 4.26; neutral/general information condition: M = 4.02, 95% CI = 3.91 to 4.12); participants in cons/risks comparison condition perceived the story as more negative (M = 2.08, 95% CI = 1.97 to 2.20); participants in the contradictory messages condition reported the content was a mix of both (M = 3.01, 95% CI = 2.95 to 3.07). Therefore, manipulation was successful [$F(3, 645) = 367.41$, $p < .001$, $\eta^2 = .63$].

Testing hypotheses

H1: Compared with one-sided, consistent messages, exposure to contradictory health messages will be significantly associated with greater perceived conflict.

As predicted, exposure to contradictory health messages significantly increased perceived conflict [$F(3, 645) = 186.67$, $p < .001$, $\eta^2 = .47$]. Participants in this condition reported greater perceived conflict compared to three comparison groups (contradictory messages: M = 4.06, 95% CI = 3.92 to 4.21; pros/benefits: M = 2.34, 95% CI = 2.21 to

2.47; cons/risks: M = 2.33, 95% CI = 2.19 to 2.47; neutral/general information: M = 2.01, 95% CI = 1.90 to 2.13). So, H1 was supported.

H6: Higher self-relevance individuals will report greater message derogation and counterarguing toward the dissonant message (H6a); lower self-relevance individuals will report the same level of message derogation and counterarguing toward both messages (H6b).

Means and 95% CI of message derogation and counterarguing by self-relevance were reported in Table 4.1.

Table 4.1 *Means of defensive processing indicators by self-relevance for contradictory messages condition (n = 162)*

	Counterargument		Message derogation	
	Pro story	Con story	Pro story	Con story
Low self-relevance	3.25	2.68	3.07	2.76
	[2.97, 3.52]	[2.38, 2.98]	[2.83, 3.31]	[2.49, 3.02]
Medium self-relevance	3.07	3.08	2.96	3.09
	[2.78, 3.36]	[2.80, 3.36]	[2.73, 3.19]	[2.86, 3.32]
High self-relevance	3.16	3.51	2.87	3.38
	[2.87, 3.45]	[3.26, 3.77]	[2.63, 3.12]	[3.14, 3.62]

As predicted, in the contradictory messages condition, high self-relevance individuals (i.e., heavy coffee drinkers who also thought drinking coffee was important) reported greater counterarguing and message derogation toward the news story focusing on the potential risks of coffee consumption than the story discussing the potential benefits [counterarguing: $F(1,58) = 4.82$, $p = .032$, partial $\eta^2 = .08$; message derogation: $F(1,58) = 14.64$, $p < .001$, partial $\eta^2 = .20$]. Interestingly, low self-relevance individuals (i.e., light coffee drinkers who thought drinking coffee was unimportant) also engaged in defensive processing, such that they reported greater counterarguing and message derogation toward the story about health benefits of drinking coffee than the story about

risks [counterarguing: $F(1,50) = 9.22$, $p = .004$, partial $\eta^2 = .16$; message derogation: $F(1,50) = 4.16$, $p = .047$, partial $\eta^2 = .08$]. There were no signals of defensive processing among medium self-relevance individuals [counterarguing: $F(1,51) = .002$, $p = .964$, partial $\eta^2 = .00$; message derogation: $F(1,51) = .96$, $p = .332$, partial $\eta^2 = .02$]. Thus, H6a was supported but H6b was not supported.

Additional analyses

To further explore whether both high and low self-relevance individuals would process messages—that are inconsistent with their perceptions and/or behaviors—defensively, message derogation and counterarguing by self-relevance were calculated for those in pros/benefits comparison condition and cons/risks comparison condition and reported in Table 4.2.

Table 4.2 *Means of defensive processing indicators by self-relevance for pros/benefits and cons/risks comparison conditions (pros/benefits: n = 167; cons/risks: n = 158; total: n = 325)*

	Counterarguing		Message derogation	
	Pros condition	Cons condition	Pros condition	Cons condition
Low self-relevance	3.41 [3.11, 3.71]	2.52 [2.20, 2.85]	2.84 [2.65, 3.04]	2.48 [2.23, 2.73]
Medium self-relevance	3.03 [2.72, 3.34]	2.99 [2.66, 3.33]	2.80 [2.54, 3.05]	3.05 [2.79, 3.31]
High self-relevance	2.74 [2.40, 3.08]	3.26 [2.97, 3.56]	2.72 [2.47, 2.98]	2.92 [2.68, 3.16]

Similar to H6 findings, low self-relevance individuals reported greater counterarguing and message derogation toward the pros/benefits message [counterarguing: $F(1,110) = 16.16$, $p < .001$, partial $\eta^2 = .13$; message derogation:

$F(1,110) = 5.19$, $p = .025$, partial $\eta^2 = .05$]. High self-relevance individuals only showed increased counterarguing but not message derogation toward the cons/risks message [counterarguing: $F(1,115) = 5.45$, $p = .021$, partial $\eta^2 = .05$; message derogation: $F(1,115) = 1.29$, $p = .258$, partial $\eta^2 = .01$]. Again, defensive processing did not occur among medium self-relevance individuals [counterarguing: $F(1,94) = .03$, $p = .860$, partial $\eta^2 = .00$; message derogation: $F(1,94) = 1.90$, $p = .171$, partial $\eta^2 = .02$]. Therefore, such findings provide additional evidence that both high and low self-relevance individuals may engage in defensive processing when encountering information that contradicts their beliefs and committed behaviors.

Discussion

It was hypothesized that people would infer conflict after exposure to contradictory health messages. Confirming this hypothesis, the results showed participants in the contradictory messages condition reported significantly greater perceived conflict than those in three comparison conditions which included one-sided, convergent messages. Even without contrasting against comparison conditions, the mean score of perceived conflict (4.06 on a 5-point scale) for the contradictory messages condition indicates that people indeed recognized the inconsistency across distinct messages even when such inconsistency or conflict was not highlighted. Additionally, perceived conflict did not vary by self-relevance [$F(2, 646) = .053$, $p = .948$, $\eta^2 = .00$], supporting the proposed model of effects that perceived conflict arises regardless of the violation of self-concept.

Drawing on literature about defensive processing, I also expected that high self-relevance individuals would be more likely to engage in defensive processing of

contradictory messages than low self-relevance individuals. Partially confirming this hypothesis, heavy coffee drinkers who think drinking coffee is important (i.e., high self-relevance) showed greater counterarguing and message derogation toward the cons/risks messages about coffee consumption, while surprisingly there is evidence that non-routine coffee drinkers who think drinking coffee does not matter (i.e., low self-relevance) also engaged in defensive processing, such that they reported greater counterarguing and message derogation toward the pros/benefits messages. This finding was not expected but is theoretically plausible. In a certain sense, low self-relevance means having strong opinions against a behavior, so exposure to messages promoting that behavior—which contradict their prior beliefs and/or behaviors—may threaten their positive self-concept as an intelligent person and thus trigger defensive processing. Additionally, as medium self-relevance individuals did not hold strong opinions, they did not process any messages defensively. So, the topic of coffee consumption is in fact relevant for both high and low self-relevance individuals because they feel strongly about the topic—either pro or against that behavior; in contrast, the topic is less relevant for medium self-relevance individuals. Combined, defensive processing of contradictory messages is more likely to occur among those holding strong priors.

Wave 2 Study 2

Method

Procedure

After consenting to participate, participants were randomly assigned to one of five conditions, including the same four conditions in Study 1 plus one more condition

that represented messages about contradiction. As explained in Chapter 1, it may be easier for people to infer conflict after exposure to *messages about contradiction* than *contradictory messages*. Thus, theoretically, including a condition of *messages about contradiction*—compared to a condition of *contradictory messages* and one-sided message comparison conditions—should produce a greater level of perceived conflict. Adding another level of perceived conflict may help better explicate the relationships between perceived conflict and outcome variables. The stimulus representing messages about contradiction highlighted inconsistency across nutrition studies about coffee consumption (e.g., "an increasing number of studies involving coffee consumption provide conflicting results," "there has been a history of medical flip-flops on how coffee may affect your health").

So, Wave 2 Study 2 had three one-sided comparison conditions: pros/benefits condition (comparison 1), cons/risks condition (comparison 2), neutral/general information condition (comparison 3); and two exposure to conflict conditions: contradictory messages condition (CM condition) and messages about contradiction condition (MC condition).

Following stimulus exposure, participants answered post-test outcome questions. Last, a manipulation check question examining participants' understanding of stimulus was presented. Since data were collected during the COVID-19 pandemic when a large volume of conflicting information surrounding COVID-19 arose, several COVID-19 related questions adapted from the Pew Research Center's American News Pathways survey were asked at the end of study (Pew Research Center, 2020b), which provided additional background information (full questionnaire included in Appendix G).

Measures

Affective responses. Adapted from Nabi and colleagues (2006; 2016), participants were asked to report on scales from 1 (*very little*) to 5 (*very much*) about how they felt having read the news content. Four items related to fear were fearful, nervous, anxious, and worried; four items related to anger were frustrated, irritated, angry, and annoyed; three items related to surprise were amazed, surprised, and astonished. The order of seeing each discrete emotion measure was randomized. Items for each emotion were averaged to create scales for fear, anger, and surprise respectively (fear: range = 1.00 – 5.00, M = 1.73, SD = 1.02; anger: range = 1.00 – 5.00, M = 1.58, SD = .90; surprise: range = 1.00 – 5.00, M = 2.66, SD = 1.16), which all demonstrated strong internal consistency (fear: Cronbach's α = .96; anger: Cronbach's α = .93; surprise: Cronbach's α = .90).

Topic-specific confusion. Topic-specific confusion measures were adapted from Nagler (2010). On a 5-point scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*), participants were asked to indicate their opinions on three randomly presented statements: "It is not clear to me whether drinking coffee is best for me," "I find research on coffee consumption to be confusing," and "Research findings on coffee consumption make sense to me." The last item was reverse-coded so that a lower score signified greater topic-specific confusion. Items were averaged to create a topic-specific confusion scale (range = 1.00 – 5.00, M = 2.90, SD = .96), which showed good internal consistency (Cronbach's α = .79). For the overall scale, a higher score indicated greater topic-specific confusion.

Topic-specific ambivalence. Attitudinal ambivalence can be defined as holding both positive and negative evaluations toward an object at the same time (Thompson et al., 1995). However, there is disagreement about how best to measure ambivalence (Hohman et al., 2013; Nowlis et al., 2000; Schneider & Schwartz, 2017). A single item measure, "I have mixed feelings about…," has been used in previous research to assess attitudinal ambivalence (e.g., Han et al., 2014; Nagler et al., 2019; Sawicki et al., 2013). Thus, participants responded to the statement, "I have mixed feelings about drinking coffee" on a 5-point scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). To move away from the limitations of single-item measurement, two items were added based on the definition of attitudinal ambivalence and previous measures (Priester & Petty, 1996): "I am torn about drinking coffee" and "I am indecisive about drinking coffee." As explained by Priester and Petty (1996), "mixed" is an indicator of the cognitive basis, "conflicted" (here, "torn" to avoid conflation with perceived conflict) is an indicator of affective basis, and "indecisive" is an indicator of behavioral basis. Three items were averaged to create an ambivalence scale (range = 1.00 – 5.00, M = 2.45, SD = 1.13), which showed strong internal consistency (Cronbach's α = .92).

General confusion. Again, adapted from Nagler (2014), participants responded to six randomly presented statements on 5-point scales ranging from 1 (*strongly disagree*) to 5 (*strongly agree*): "It is not always clear to me what foods are best for me," "I find nutrition recommendations to be confusing," "Nutrition research findings make sense to me," "I know what I should be eating to stay healthy," "I find nutrition research studies hard to follow," and "I understand scientists' recommendations about what foods I should eat." The third, fourth, and sixth items were reverse-coded so that a lower score

indicated greater confusion. A general confusion scale was calculated by averaging these items (range = 1.00 – 5.00, *M* = 2.57, *SD* = .78), which showed good internal consistency (Cronbach's α = .85). For the overall scale, a higher score indicated greater general confusion.

Backlash. To measure backlash toward nutrition recommendations and research, six items borrowed from Nagler (2014) were randomly presented to participants: "I am tired of hearing about what foods I should or should not eat," "Scientific research provides good guidance about the best foods to eat," "The evidence about healthy food choices is growing," "Dietary recommendations should be taken with a grain of salt," "Scientists really don't know what foods are good for you," and "I pay attention to new research on food and nutrition." Response options ranged from 1 (*strongly disagree*) to 5 (*strongly agree*). The second, third, and sixth items were reverse-coded so that a lower score indicated greater backlash. Again, items were averaged to create a backlash scale (range = 1.00 – 4.50, *M* = 2.57, *SD* = .62), which showed acceptable internal consistency (Cronbach's α = .70). A higher value on the overall scale indicated greater backlash.

Media skepticism. Respondents were asked a series of questions relating to potentially different components of media skepticism. Based on the measures of media skepticism used by Tsfati and Cappella (2003), five selected items were included. First, participants were asked "How much of the time do you think you can trust media organizations to report the news fairly?" Response options included "Just about always" "Most of the time" "Only some of the time" and "None of the time." This item has been used by the National Election Studies (NES) since 1996. Then, four items assessing

perceived news credibility were presented (Gaziano & McGrath, 1986). Specifically, participants were asked to reflect on the news media in general and indicated their opinions whether they thought the news media: "are fair," "tell the whole story," "are accurate," and "can be trusted" on 5-point scales ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). These news credibility items demonstrated strong internal consistency (Cronbach's $\alpha = .90$), and were recoded so that a higher value signified greater skepticism. Consistent with previous research (Tsfati & Cappella, 2003), factor analysis confirmed that five selected items loaded on the same factor (Cronbach's $\alpha = .90$). Items were averaged to create media skepticism scale 1 (range = 1.00 – 5.00, $M = 3.26$, $SD = .79$; note that the NES item was rescaled from 1.00 – 4.00 to 1.00 – 5.00 when calculating the scale). Since Tsfati and Cappella's measure of media skepticism is slightly outdated, another measure adapted from Yamamoto and Kushin (2014) was also used. Respondents indicated their opinions on four randomly presented statements: "It's important to critically evaluate what news stories say," "I think about news stories before I accept them as believable," "I am questioning which information is accurate in the news media," and "I always think twice about statements made in news stories." Response options ranged from 1 (*strongly disagree*) to 5 (*strongly agree*). These four items were averaged to create media skepticism scale 2 (range = 1.00 – 5.00, $M = 4.17$, $SD = .59$), which also showed good internal consistency (Cronbach's $\alpha = .79$). Pearson's correlation between two media skepticism measures was .39 ($p < .001$).

Manipulation check. At the end of the experiment, participants were asked one question designed to serve as a manipulation check and examine whether the stimuli messages had successfully elicited different levels of perceived conflict: "Based on the

health news information you saw earlier, please indicate whether you think the news content you saw was: 'contradictory,' 'inconsistent,' and 'conflicting.'" Response options ranged from 1 (*strongly disagree*) to 5 (*strongly agree*). Items were averaged to create a scale (range = 1.00 – 5.00, $M = 2.98$, $SD = 1.21$) and showed strong internal consistency (Cronbach's $\alpha = .97$). Theoretically, perceived conflict would be greatest in MC condition, followed by CM condition, and lowest in three comparison conditions. Yet, as described in Chapter 2 ("Stimuli development and pretest"), the pilot study showed that exposure to CM might produce similar or even greater level of perceived conflict compared with MC. For the topic of coffee consumption specifically, the means of perceived conflict were 4.38 for the CM condition and 3.57 for the MC condition (Appendix D). Therefore, the Study 2 manipulation would be considered successful if those in the two exposure to conflict conditions (CM and MC conditions) reported significantly greater perceived conflict than those in the three one-sided message comparison conditions.

Analytic approach

First, descriptive analyses were performed to understand data distribution of outcome variables. Then a one-way ANOVA test was used to examine whether participants perceived expected different levels of conflict after message exposure. Next, to test the relationships between perceived conflict and cognitive (H2) and affective (H3) outcome variables, several one-way ANOVA tests were performed. If statistically significant, then post-hoc Tukey's honest significant test (HSD) was used to compare means of outcomes by experimental condition. H4 and H5 on the mediating role of perceived conflict were examined based on the results of Study 1 and Study 2. If H1

(i.e., contradictory messages exposure–perceived conflict relationship) as well as H2 and H3 (i.e., perceived conflict–cognitive response relationships, perceived conflict–affective response relationships) were supported, then there would be evidence for mediation. Last, to examine the moderating role of self-relevance on relationships between perceived conflict and topic-specific confusion, ambivalence, anger, fear, and surprise (H7, H8, and RQ), several two-way ANOVA tests were performed with the experimental condition and self-relevance as the two factors. All analyses were performed using SPSS Statistics version 27.

Results

Sample characteristics

A total of 850 participants completed Wave 2 Study 2. After removing responses from four participants who failed attention check, 846 responses were included in analysis. The ages of participants ranged from 18 to 77 years with an average age of 32.68 (*SD* = 12.22) and about half of the sample was female (49.5%). More than 50% of participants had a Bachelor's degree or higher (53.8%) while 12.6% had completed high school or less than high school education. A majority of participants identified themselves as White (62.9%), 6.0% identified as Black or African American, 13.8% identified as Asian, and the remainder identified as other or multiple races (17.1%). Full sample characteristics are provided in Appendix H.

Randomization to experimental condition was successful, as there were no significant differences across conditions in age, gender, education, race/ethnicity, and self-relevance level (by design) (all *p*s > .07).

Additionally, 83.2% of participants followed news about COVID-19 outbreak closely. While a majority of participants thought the news media had covered the outbreak well (68.5%), a smaller proportion thought public health officials had responded to the outbreak well (39.3%). Perhaps more germane to the current study, 42.8% of participants had mostly seen conflicting facts across news sources while 50.6% reported mostly seeing the same set of facts. News about the outbreak also had some negative effects on emotions: 68.3% felt the need to take breaks from outbreak related news and 56.5% reported keeping up with news made them felt worse emotionally. Details about these COVID-19 items are reported in Appendix H.

Manipulation check

Consistent with expectation, exposure to conflict significantly increased perceived conflict [$F(4, 841) = 183.27$, $p < .001$, $\eta^2 = .47$]. In other words, participants in two exposure to conflict conditions reported greater perceived conflict than three comparison conditions (pros/benefits: $M = 2.32$, 95% CI = 2.17 to 2.46; cons/risks: $M = 2.47$, 95% CI = 2.33 to 2.61; neutral/general information: $M = 2.16$, 95% CI = 2.04 to 2.29; CM: $M = 4.18$, 95% CI = 4.04 to 4.31; MC: $M = 3.77$, 95% CI = 3.64 to 3.89). It is worth noting that contrary to theoretical prediction but consistent with pilot study findings, CM condition was associated with a greater level of perceived conflict than MC condition. So, compared to those exposed to MC, participants in the CM condition should report similar or even greater levels of negative cognitions and emotions.

Testing hypotheses and answering research question

H2: Perceived conflict will be significantly associated with greater cognitive responses; specifically, topic-specific confusion (H2a), more general confusion (H2b), ambivalence (H2c), backlash (H2d), and media skepticism (H2e).

Means and 95% CI of cognitive outcomes are reported in Table 4.3. As predicted, there were significant differences in topic-specific confusion [$F(4, 841) = 54.02$, $p < .001$, $\eta^2 = .20$], general confusion [$F(4, 841) = 10.85$, $p < .001$, $\eta^2 = .05$], ambivalence [$F(4, 841) = 10.57$, $p < .001$, $\eta^2 = .05$], and backlash [$F(4, 841) = 3.83$, $p = .004$, $\eta^2 = .02$] across conditions. Media skepticism did not vary by condition [measure 1: $F(4, 841) = .68$, $p = .609$, $\eta^2 = .00$; measure 2: $F(4, 841) = 1.62$, $p = .168$, $\eta^2 = .01$]. Specifically, when using the pros/benefits condition or the neutral/general information condition as the reference group, CM and MC conditions were associated with greater topic-specific confusion, general confusion, and ambivalence; additionally, MC condition was also associated with greater backlash. When using the cons/risks condition as the reference group, CM condition was only associated with greater topic-specific confusion; MC condition increased general confusion along with topic-specific confusion. Taken together, perceived conflict only heightened some, but not all, cognitive responses. Thus, H2a was fully supported; H2b-H2d were partially supported; H2e was not supported.

Table 4.3 *Means and 95% CI of cognitive responses by experimental condition (N = 846)*

	Topic-specific confusion	General confusion	Ambivalence	Backlash	Media skepticism 1	Media skepticism 2
a. Comparison 1 (pros)	2.52[d,e]	2.46[d,e]	2.11[b,d,e]	2.49[e]	3.26	4.23
	[2.39, 2.65]	[2.35, 2.58]	[1.95, 2.27]	[2.39, 2.59]	[3.13, 3.38]	[4.15, 4.31]
b. Comparison 2 (cons)	2.60[d,e]	2.56[c,e]	2.67[a,c]	2.57	3.19	4.10
	[2.46, 2.74]	[2.45, 2.67]	[2.50, 2.84]	[2.48, 2.67]	[3.06, 3.31]	[4.00, 4.20]
c. Comparison 3 (neutral)	2.51[d,e]	2.33[b,d,e]	2.19[b,d,e]	2.46[e]	3.32	4.16
	[2.39, 2.63]	[2.23, 2.44]	[2.04, 2.34]	[2.37, 2.55]	[3.20, 3.44]	[4.07, 4.25]
d. CM	3.43[a,b,c]	2.72[a,c]	2.71[a,c]	2.64	3.27	4.21
	[3.29, 3.56]	[2.61, 2.84]	[2.52, 2.89]	[2.55, 2.74]	[3.15, 3.38]	[4.12, 4.30]
e. MC	3.43[a,b,c]	2.79[a,b,c]	2.55[a,c]	2.68[a,c]	3.28	4.12
	[3.30, 3.56]	[2.67, 2.90]	[2.38, 2.73]	[2.59, 2.77]	[3.17, 3.39]	[4.03, 4.20]

Note. Significant differences between conditions are marked by the superscript letters ($p < .05$).

H3: Perceived conflict will be significantly associated with greater affective responses to the messages they read; specifically, anger (H3a), fear (H3b), and surprise (H3c).

Means and 95% CI of affective outcomes are reported in Table 4.4. Consistent with prediction, there were significant differences in anger [$F(4, 841) = 17.90$, $p < .001$, $\eta^2 = .11$], fear [$F(4, 841) = 35.06$, $p < .001$, $\eta^2 = .14$], and surprise [$F(4, 841) = 25.77$, $p = .004$, $\eta^2 = .11$] across conditions. Similar to what was done for H2, different comparison conditions were used as the reference group in comparing effects on affective responses after exposure to conflict. When the reference group was the pros/benefits condition or the neutral/general information condition, greater anger and fear as well as less surprise were reported by participants in both CM and MC conditions; thus, H3a and H3b were supported and H3c was not supported. When using the cons/risks condition as the reference group, CM condition was associated significantly greater anger but less fear; MC condition was associated with less fear and surprise; thus, H3a-H3c were not supported. In general, there was some evidence that perceived conflict increased anger and fear but decreased surprise. Perhaps, it is also worth noting that those in the CM condition felt more surprised than those in the MC condition.

Table 4.4 *Means and 95% CI of affective responses by experimental condition (N = 846)*

	Anger	Fear	Surprise
a. Comparison 1 (pros)	1.23[a,d,e]	1.24[b,d,e]	2.91[b,c,d,e]
	[1.14, 1.32]	[1.16, 1.33]	[2.73, 3.09]
b. Comparison 2 (cons)	1.67[a,c,d]	2.32[a,c,d,e]	2.49[a,c,e]
	[1.54, 1.80]	[2.14, 2.49]	[2.33, 2.65]
c. Comparison 3 (neutral)	1.25[b,d,e]	1.40[b,d,e]	3.25[a,b,d,e]
	[1.16, 1.34]	[1.29, 1.51]	[3.08, 3.42]
d. CM	1.96[a,b,c]	1.97[a,b,c]	2.50[a,c,e]
	[1.79, 2.13]	[1.79, 2.14]	[2.34, 2.67]
e. MC	1.77[a,c]	1.73[a,b,c]	2.14[a,b,c,d]
	[1.62, 1.92]	[1.58, 1.89]	[1.98, 2.30]

Note. Significant differences between conditions are marked by the superscript letters ($p < .05$).

H4: Cognitive effects of exposure to contradictory health messages will be mediated by perceived conflict.

H5: Affective effects of exposure to contradictory health messages will be mediated by perceived conflict.

Since H1 (i.e., contradictory messages exposure–perceived conflict relationship) was supported but H2 and H3 (i.e., perceived conflict–cognitive response relationship and perceived conflict–affective response relationship) were not fully supported, evidence for mediation of perceived conflict (H4 and H5) was not sufficient based on the manipulation-of-mediator approach.

H7: Self-relevance will moderate the perceived conflict–topic-specific confusion (H7a) and perceived conflict–ambivalence (H7b) relations; the adverse effects will be more pronounced among lower-relevance individuals.

A two-way ANOVA test indicated that there was a statistically significant interaction between perceived conflict and self-relevance on topic-specific confusion

[$F(8, 831) = 1.98$, $p = .046$, partial $\eta^2 = .019$]. There were also significant main effects of perceived conflict on topic-specific confusion [$F(4, 831) = 54.13$, $p < .001$, partial $\eta^2 = .207$], that is perceived conflict after exposure to CM and MC generated greater topic-specific confusion. No main effects were observed for self-relevance [$F(2, 831) = .21$, $p = .809$, partial $\eta^2 = .001$]. To further examine interaction effects, interaction between perceived conflict and self-relevance on topic-specific confusion was plotted in Figure 4.1. As shown in the figure, high self-relevance individuals reported greater topic-specific confusion than low self-relevance individuals when perceiving the same level of conflict after exposure to the cons/risks message about coffee consumption. There were no other meaningful differences observed in the plot, especially for CM and MC conditions. Therefore, H7a was not supported.

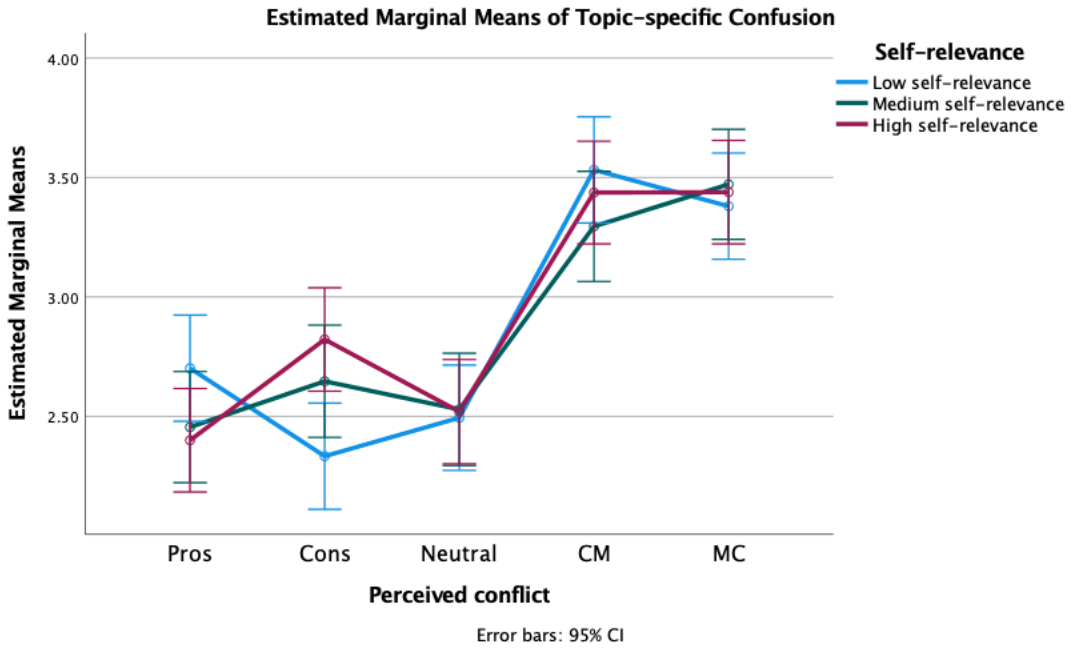


Figure 4.1 Perceived conflict × self-relevance on topic-specific confusion

As for ambivalence, a two-way ANOVA test showed that there was no statistically significant interaction between perceived conflict and self-relevance [$F(8, 831) = 1.21$, $p = .289$, partial $\eta^2 = .012$]. However, there were significant main effects of both perceived conflict [$F(4, 831) = 10.99$, $p < .001$, partial $\eta^2 = .050$] and self-relevance [$F(2, 831) = 11.20$, $p < .001$, partial $\eta^2 = .026$]. Specifically, perceived conflict after exposure to CM and MC generated greater ambivalence compared to exposure to pros/benefits and neutral/general information stories. Additionally, medium self-relevance individuals experienced significantly greater ambivalence than high self-relevance individuals. Therefore, H7b was not supported.

H8: Self-relevance will moderate the perceived conflict–anger (H8a) and perceived conflict–fear (H8b) relations; the adverse effects will be more pronounced among higher-relevance individuals.

A two-way ANOVA test revealed a significant interaction between perceived conflict and self-relevance on anger [$F(8, 831) = 2.06$, $p = .038$, partial $\eta^2 = .019$], which was plotted in Figure 4.2. High self-relevance individuals felt angrier than low self-relevance individuals when having the same level of perceived conflict after exposure to the cons/risks news story about coffee consumption. Additionally, high self-relevance individuals reported greater anger than medium self-relevance individuals when having the same level of perceived conflict after exposure to CM. Therefore, H8a was not supported.

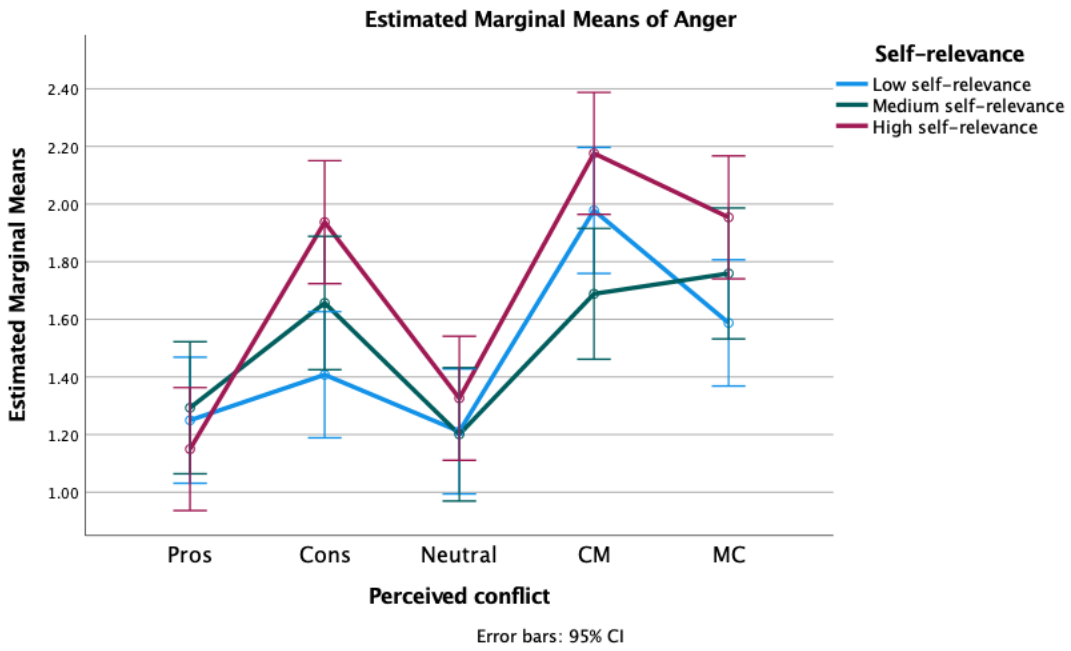


Figure 4.2 Perceived conflict × self-relevance on anger

Also, there were significant main effects of both perceived conflict [$F(4, 831) = 24.47$, $p < .001$, partial $\eta^2 = .105$] and self-relevance [$F(2, 831) = 5.91$, $p = .003$, partial $\eta^2 = .014$] on anger. Regardless of exposure condition, high self-relevance individuals on average felt angrier having read the stimulus messages than low and medium self-relevance individuals.

When focusing on fear, no significant interaction between perceived conflict and self-relevance was found using a two-way ANOVA [$F(8, 831) = 1.66$, $p = .104$, partial $\eta^2 = .016$] but significant main effects were found for perceived conflict [$F(4, 831) = 36.11$, $p < .001$, partial $\eta^2 = .148$] and self-relevance [$F(2, 831) = 9.23$, $p < .001$, partial $\eta^2 = .022$]. Specifically, perceived conflict after exposure to CM and MC was associated with greater fear than exposure to pros/benefits and neutral/general information news stories but less fear than exposure to cons/risks news story. Low self-relevance

individuals also felt significantly less fearful than high and medium self-relevance individuals. Therefore, H8b was not supported.

RQ: Will self-relevance moderate the perceived conflict–surprise relation?

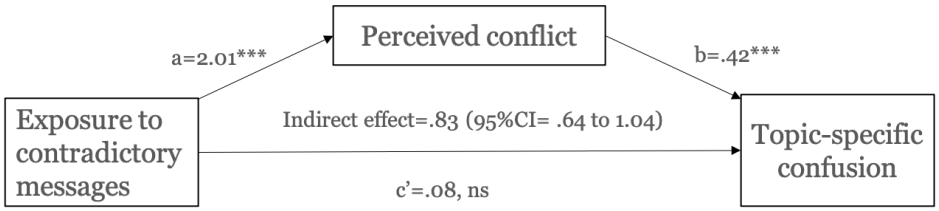
Again, a two-way ANOVA test indicated that there was no significant interaction between perceived conflict and self-relevance on surprise [$F(8, 831) = .67$, $p = .716$, partial $\eta^2 = .006$]. Significant main effects were observed for perceived conflict [$F(4, 831) = 25.29$, $p < .001$, partial $\eta^2 = .109$] but not self-relevance [$F(2, 831) = 1.06$, $p = .346$, partial $\eta^2 = .003$]. So, self-relevance did not moderate the perceived conflict–surprise relation.

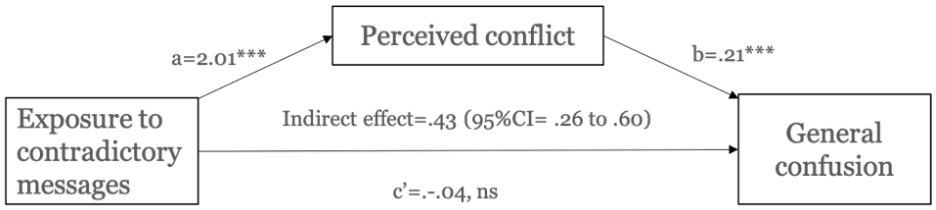
Additional analyses

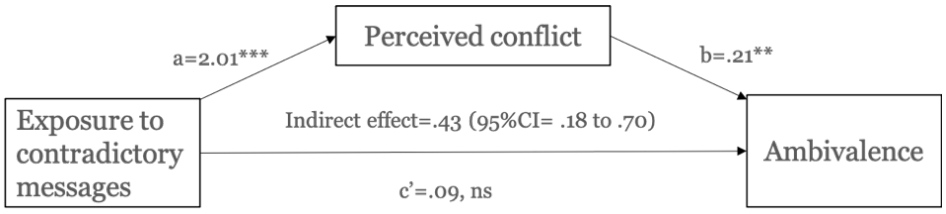
Although mediation of perceived conflict was not supported using the manipulation-of-mediator approach, it is worth further exploration with alternative approaches, given the important role of perceived conflict in contradictory information processing. Because perceived conflict was also measured in Study 2 as manipulation check, mediation could also be assessed with the measurement-of-mediator approach. Therefore, post-hoc mediation analyses were performed using Hayes' PROCESS macro for SPSS (2018). Potentially, there could be multiple comparisons among experimental conditions. But given the focus of CM in this dissertation and the exploratory nature of such analyses, only comparison group 3 (i.e., neutral/general information about coffee consumption) and CM condition were selected for mediation tests.

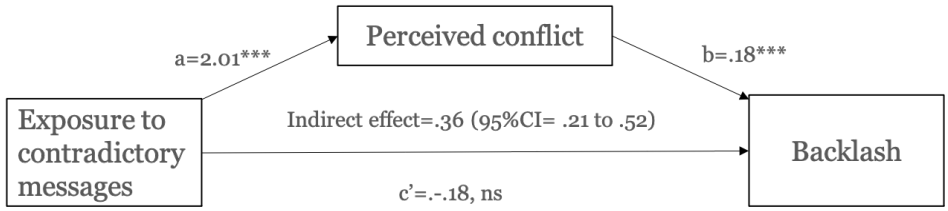
As shown in Figure 4.3, there was evidence for mediation of perceived conflict. Specifically, for the outcomes of topic-specific confusion, general confusion, ambivalence, backlash, anger, and surprise, perceived conflict fully mediated their

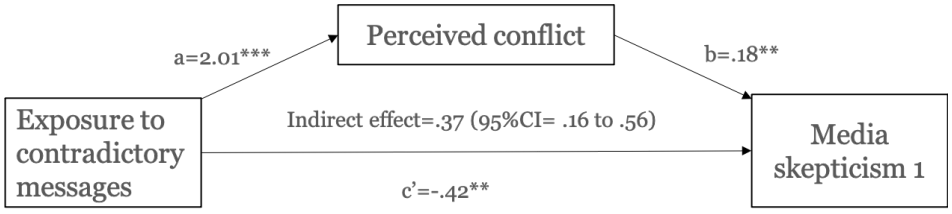
relations with exposure to CM. Since 95% CI included 0 for the indirect effect, perceived conflict did not mediate exposure to contradictory messages–fear relation. Since media skepticism was captured using two different measures, mediation analyses were conducted with each measure respectively. While there was partial mediation of perceived conflict using media skepticism measure 1, no mediation was found using media skepticism measure 2. In sum, when drawing on the measurement-of-mediator approach, more supporting evidence was found for the mediating role of perceived conflict in contradictory information processing.

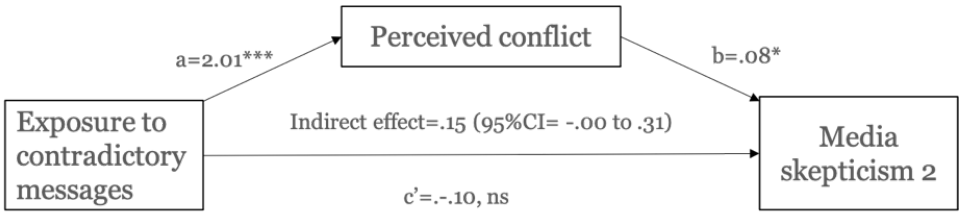


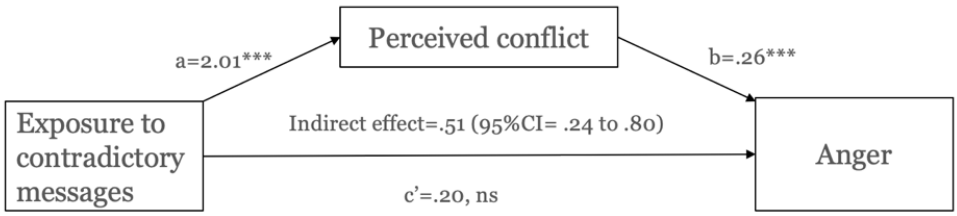


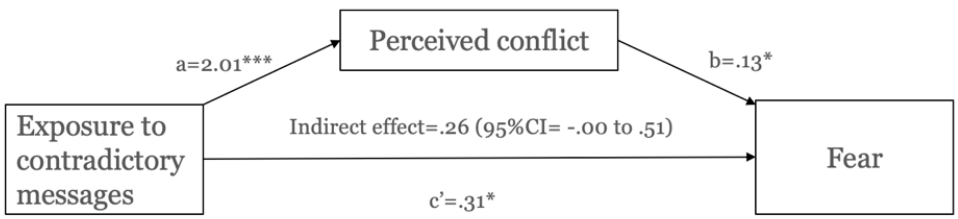



Perceived conflict
a=2.01***
b=.18***
Exposure to contradictory messages
Indirect effect=.36 (95%CI= .21 to .52)
Backlash
c'=.-.18, ns


Perceived conflict
a=2.01***
b=.18**
Exposure to contradictory messages
Indirect effect=.37 (95%CI= .16 to .56)
Media skepticism 1
c'=-.42**


Perceived conflict
a=2.01***
b=.08*
Exposure to contradictory messages
Indirect effect=.15 (95%CI= -.00 to .31)
Media skepticism 2
c'=.-.10, ns


Perceived conflict
a=2.01***
b=.26***
Exposure to contradictory messages
Indirect effect=.51 (95%CI= .24 to .80)
Anger
c'=.20, ns


Perceived conflict
a=2.01***
b=.13*
Exposure to contradictory messages
Indirect effect=.26 (95%CI= -.00 to .51)
Fear
c'=.31*

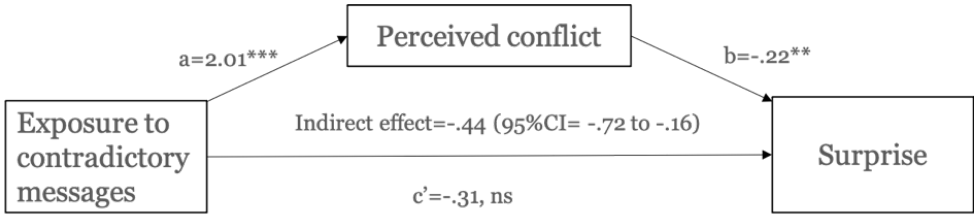


Figure 4.3 Indirect effect of perceived conflict on the relationships between exposure to contradictory messages and outcomes (n = 339, * p < .05; ** p < .01; *** p < .001). a is the coefficient for the relation between exposure to CM and perceived conflict; b is the coefficient for the relation between perceived conflict and the outcome; c' is the coefficient for the relation between exposure to CM and the outcome after adjusting for perceived conflict

Discussion

It was hypothesized that perceived conflict would be significantly associated with cognitive responses to contradictory messages, such as topic-specific confusion, more general confusion, ambivalence, backlash, and media skepticism. As perceived conflict was greatest in CM condition, followed by MC condition, then cons/risks condition, pros/benefits condition, and, last, neutral/general information condition, reported cognitive responses should go along with or at least mostly follow this order, if the hypothesis was supported. However, only topic-specific confusion results were as predicted, such that CM and MC conditions elicited significantly greater topic-specific confusion than the three comparison, no exposure to conflict conditions. While the level of general nutrition confusion is largely consistent with the hypothesized order, no difference was observed between CM and cons/risks conditions. As for ambivalence, CM, cons/risks, and MC conditions were associated with greater ambivalence than pros/benefits and neutral/general information conditions. While MC condition produced

greater backlash than pros/benefits and neutral/general information conditions, no difference was found between CM condition and other conditions. Also, media skepticism after message exposure did not differ across conditions. Taken together, although there was some evidence that greater perceived conflict led to greater cognitive responses, findings were not entirely consistent with the overall expected order of condition effects.

These findings add to the existing evidence base that exposure to contradictory messages could have adverse effects on people's cognitions, such as confusion, which is generally consistent with prior observational and experimental work (e.g., Clark et al., 2019; Lee et al., 2018; Nagler, 2014; Nagler et al., 2019). However, this was not always the case. When comparing contradictory messages with different one-sided, convergent messages, results also presented different patterns. When the comparison was pros/benefits or neutral/general information news story, CM exposure increased topic-specific confusion, general confusion, and ambivalence; when the comparison was cons/risks news story, CM exposure only increased topic-specific confusion. Such inconsistent findings across comparison groups may be explained by prior media exposure to the topic of coffee consumption. An umbrella review of meta-analyses of both observational and interventional research about coffee consumption and health found that coffee consumption was more often associated with benefit than harm for various health outcomes (Poole et al., 2017). Presumably, cons/risks messages about coffee consumption may appear less common in people's daily media consumption; in contrast, people may be more accustomed to pros/benefits messages about coffee consumption. So, pros/benefits messages may be consistent with most people's prior

exposure to the topic of coffee consumption while cons/risks messages may be considered incongruent with their prior exposure or knowledge about coffee consumption; as a result, exposure to cons/risks messages may have led to relatively greater confusion and ambivalence. This speculation is also supported by the results of manipulation check, which found that the cons/risks message condition was associated with greater perceived conflict compared to the other two convergent message conditions.

Results also presented some puzzling patterns when comparing CM and MC conditions. Specifically, CM elicited significantly greater perceived conflict than MC. Theoretically, perceived conflict should be more salient after exposure to MC because contradiction or conflict is underscored in a single news story, and it is easier for people to recognize such conflict. However, to my knowledge, this idea had not previously been empirically tested. Maybe, in fact, CM is linked to greater perceived conflict than MC. If the same patterns persist in future studies, then it is worth further investigating why CM produce greater perceived conflict than MC even without highlighting conflict. Another possibility for this finding is that MC generated greater perceived conflict but also helped resolve perceived conflict to a greater extent than CM. Because MC included contradictory study findings within a single news story, it is easier for people to notice differences (e.g., different samples) across studies, which may facilitate the resolution of perceived conflict.

A few additional observations about the cognitive outcomes should be noted. First, media skepticism was generally high across all experimental conditions (mean scores of 3.19 – 3.32 for measure 1 and 4.10 – 4.23 for measure 2 on 5-point scales).

This finding may not be surprising, as a recent Pew Research Center survey showed that public trust in news media has been declining and roughly two-thirds of Americans think it is better for society if the public is skeptical of the news media (Pew Research Center, 2020c). Such relatively high baseline levels of media skepticism may make it difficult to observe significant differences across conflict conditions with a single exposure. Also, the hypothesized effect of exposure to conflict on media skepticism was based on the assumption that people would attribute emergence of contradictory health information to the news media. Yet, this is not empirically tested. It is possible that most people think scientists should be responsible for contradictory findings rather than the news media, and thus exposure to conflict may have limited effects on perceptions related to the news media. Second, although exposure to conflict seemed to cast some influence on the outcomes of topic-specific confusion, ambivalence, general nutrition confusion, and backlash, the degree of influence differed across these outcomes. When comparing exposure to conflict conditions with one-sided message conditions, the mean difference in topic-specific confusion and ambivalence appeared overall to be larger than for general confusion and backlash. One possible explanation is that topic-specific confusion and ambivalence are topic-specific responses while general nutrition confusion and backlash are markers of spillover effects. Conceptually, compared with more general spillover outcomes, topic-specific responses are much more proximal to topic-specific conflicting information. Effects of exposure to topic-specific conflicting information on cognitions may diminish in moving from topic-specific cognitions to more general health cognitions.

Similar to cognitive responses, it was also assumed that greater perceived conflict would be linked to greater affective responses, such as anger, fear, and surprise. While the results of anger were generally in line with the prediction and prior research (Nagler et al., 2019), fear and surprise showed unexpected patterns. Specifically, fear was greatest among those in cons/risks condition, followed by those in CM and MC conditions, and was lowest among those in pros/benefits and neutral/general information conditions. Surprise was greatest in neutral/general information condition, followed by pros/benefits condition, and then CM and cons/risks conditions, and was lowest in MC condition. So, these findings provided partial support that exposure to conflict was associated with greater negative emotions, such as anger and fear, than no exposure to conflict. However, under certain circumstances, for example, exposure to one-sided messages underscoring the health risks of heavy coffee consumption (e.g., early death from heart attack), people may also experience high level of fear. Likewise, if one-sided messages provide interesting, new information about a topic that is less familiar among the public (e.g., beanless coffee without the bitterness), people may feel more surprised reading such messages than reading contradictory research findings about coffee consumption that may appear more often during their daily news reading.

Additionally, I proposed that self-relevance may act as a moderator of the perceived conflict–cognition and perceived conflict–emotion relationships. Because Wave 2 Study 1 found that both high and low self-relevance individuals were more likely to engage in defensive processing of contradictory messages than medium self-relevance individuals, the original hypotheses regarding the moderating effects of self-relevance should be modified accordingly. In particular, perceived conflict–cognition

relationships will be more pronounced among medium self-relevance individuals compared with high and low self-relevance individuals; perceived conflict–emotion relationships will be more pronounced among high and low self-relevance individuals than medium self-relevance individuals. However, no meaningful interaction effects were found between perceived conflict and self-relevance on any outcomes of interest. While a prior cross-sectional survey found that routine coffee drinkers were less confused about coffee consumption than non-routine coffee drinkers when exposed to greater amounts of contradictory nutrition information (Nagler, 2010), the current study did not replicate such findings. I speculate such inconsistency was caused by different approaches to capturing participants' priors. Nagler only measured prior behavior frequency whereas I assessed both behavior frequency and perceived importance of performing that behavior for the concept of self-relevance.

Interestingly, there were significant main effects of self-relevance on the outcomes of ambivalence, anger, and fear. Specifically, compared with medium self-relevance individuals, high self-relevance individuals reported less ambivalence, perhaps because they already significantly leaned toward drinking coffee and a single exposure was not powerful enough to change their strong behavioral intentions. Additionally, on average, high self-relevance participants experienced more anger than both low and medium self-relevance participants; both medium and high self-relevance participants experienced greater fear than low self-relevance participants. Such significant differences were presumably driven by reading news stories in cons/risks, CM, and MC conditions, which all included content about potential health risks of coffee consumption. Because such content violated a heavy coffee drinker's goal as an

intelligent or healthy person, negative emotions such as anger may arise. Also, since risks of heavy coffee consumption clearly are not relevant for light coffee drinkers, it is conceivable that they may not experience fear after reading such content.

CHAPTER 5: GENERAL DISCUSSION AND CONCLUSIONS

There is growing evidence that media exposure to conflicting health information can produce public confusion, generate backlash toward scientific research, and lower intentions to perform recommended health behaviors. To mitigate such adverse effects, effective interventions are needed. Yet, little is known about *how* contradictory messages are processed. To further our understanding of information processing of conflicting health information, especially contradictory messages as described in this dissertation, I asked two questions: 1) are effects of exposure to contradictory messages mediated by perceived conflict, and 2) does self-relevance prompt differential processing of contradictory messages? A two-wave study was conducted: the Wave 1 survey identified coffee consumption as the appropriate health context, which had approximately equal numbers of participants with varying levels of self-relevance; the Wave 2 experiments answered the two overarching research questions.

Summary of findings

Mediating role of perceived conflict

According to the manipulation-of-mediator approach, if the independent variable (i.e., exposure to conflict) significantly changes the mediator (i.e., perceived conflict) in experiment 1, and the mediator (i.e., perceived conflict) significantly influences the dependent variable (i.e., cognitive and affective outcomes) in experiment 2, then there is evidence for mediation (MacKinnon et al., 2007; Pirlott & MacKinnon, 2016). In the current study, Wave 2 Study 1 showed that exposure to two separate contradictory messages significantly increased perceived conflict; however, Wave 2 Study 2 indicated

that perceived conflict induced by exposure to conflict was not always associated with greater cognitive and affective responses. Thus, through the lens of the manipulation-of-mediator approach, effects of exposure to contradictory messages are not always mediated by perceived conflict. As the mediator was measured as manipulation check in Wave 2 Study 2, it was possible to use an alternative measurement-of-mediator approach to testing mediation through statistical analyses. Focusing on the neutral message and contradictory messages conditions, post-hoc mediation analyses revealed that perceived conflict fully or partially mediated most exposure to contradictory messages–outcome relationships. Assessing mediation with two different approaches can be considered triangulation. As the results did not completely converge, at this point it is difficult to reach a clear conclusion regarding whether perceived conflict always functions as a mediator in processing contradictory health messages. It seems that exposure to contradictory messages induced perceived conflict, which subsequently increased topic-specific confusion, general confusion, ambivalence, anger, and fear. Perceived conflict (elicited by contradictory messages) did not lead to greater backlash, media skepticism, or surprise.

Differential processing triggered by self-relevance

According to the study's conceptual model of effects, processing of contradictory health information may differ by self-relevance. When exposed to contradictory messages, high self-relevance individuals may engage in defensive processing of dissonant messages whereas low self-relevance individuals may process both contradictory messages similarly; in turn, high self-relevance individuals may report less topic-specific confusion and ambivalence but more intense negative emotions than low

self-relevance individuals. Contrary to my prediction, Wave 2 Study 1 demonstrated that both high and low self-relevance individuals reported increased counterarguing and message derogation toward the dissonant messages (that contradicted their strong priors), while medium self-relevance individuals did not engage in defensive processing. Wave 2 Study 2 further found that effects of exposure to contradictory messages, such as topic-specific confusion, ambivalence, anger, fear, and surprise, did not vary by self-relevance.

Implications of findings

As shown in Figure 5.1 below, people may encounter contradictory health information, then perceive conflict, which, in turn, could lead to cognitive and affective outcomes, and ultimately lowered engagement in recommended health behaviors. Thus, to offset the negative impact of contradictory health messages, we could potentially intervene at different points along this causal pathway. For example, interventions could target the production stage of health news. Scholars have provided several suggestions for journalists to improve their quality of reporting, such as trying not to report preliminary findings (Schwartz & Woloshin, 2004). While the latest findings are more newsworthy, there is a chance that such findings may be proven wrong later. When reporting such studies, journalists should at least highlight cautions in interpreting findings. Interventions could also address adverse cognitive and affective outcomes and consequently prevent the undesirable health behaviors. When feeling confused about a particular health topic, people could turn to their health care providers for more information. While Carpenter et al. (2010) found that exposure to conflicting medication

information was associated with less medication adherence, they also observed that physician support was associated with greater medication adherence.

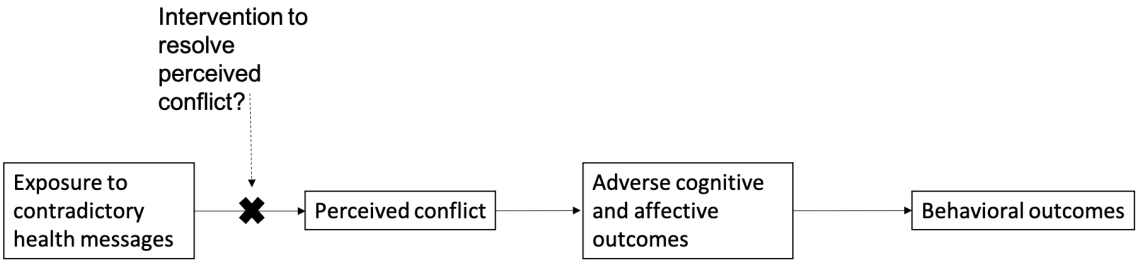


Figure 5.1 Exposure to contradictory messages–adverse outcomes causal pathway

To the extent that perceived conflict mediates exposure to contradictory information–outcome relationships, interventions that can successfully help people to resolve such conflict would mitigate adverse effects. One promising intervention strategy is hedging—containing caveats, limitations, or other indicators of scientific uncertainty in reporting—which prior research found successfully improved perceived credibility of journalists and scientists (Jensen, 2008). Applying hedging in media messages, journalists may facilitate public recognition that conflicting study findings may be caused by different designs, samples, and/or measures. However, this possibility needs to be empirically tested and substantiated in the context of contradictory health information. In addition to journalists, researchers and their institutions are also vital in improving the quality of health journalism, as they often serve as credible information sources in media coverage. Research institutions and academic journals sometimes issue press releases about scientific findings, which may be picked up by journalists. Yet, there is evidence that the quality of these press releases also varies greatly (Woloshin et

al., 2009). Similar to news coverage, press releases were found to often omit key facts and fail to acknowledge important study limitations. Ensuring the quality of such press releases may also help to prevent distortion of media coverage of scientific study findings, which may facilitate navigation of contradictory health messages.

In addition, the ability to resolve perceived conflict may depend on some personal characteristics, such as research literacy (defined as one's understanding of scientific terms and constructs) (Miller, 1998). Messaging strategy may help to curb adverse effects insofar as the public has a sufficient understanding of scientific practice. After all, if one does not know how science works, providing more contextual and methodological information may only add to confusion. Thus, interventions aimed at improving research literacy, either through school-based settings or informal learning opportunities (e.g., education entertainment), may help people to better reconcile seemingly conflicting research findings and subsequently avoid adverse effects of exposure to conflict. In fact, interventions targeting research literacy may seem more promising than messaging strategies targeting health news, as the public may encounter contradictory health information from sources beyond news media, such as entertainment media, family and friends, and even physicians.

Because the current study did not find meaningful moderating effects of self-relevance on exposure to contradictory messages–outcome relationships, it may not be necessary to develop varying intervention strategies targeting different self-relevance subgroups. However, it is worth emphasizing that this finding may only apply to the health context of coffee consumption, or by extension, routine nutrition behaviors.

Whether the null findings of moderating effects of self-relevance are also true of other health topics needs further exploration.

Limitations and future directions

Study results should be interpreted in light of several observations. First, participants were exposed to contradictory heath messages at a single time, which does not reflect real-world exposure to such messages. It is more likely for people to have distinct exposures to contradictory messages over time. On the one hand, effects of exposure to contradictory messages on perceived conflict may become attenuated in real-life settings. To infer conflict, people must attend to at least two separate contradictory messages at different occasions; and also recall previous exposure at a later time, which might be challenging for some people. On the other hand, it is also possible that perceived conflict may be heightened due to cumulative exposure to conflicting information about the same health topic across different media sources. Future research should consider a longitudinal design, which would expose participants to one message at Time 1; then show another message, that is either consistent or inconsistent with the Time 1 message, and measure perceived conflict at Time 2. Such a design might better represents real-world media exposure to contradictory health messages.

Second, the current design of a single message within each condition may be vulnerable to case-category confound issues (Jackson et al., 1989). While all messages were matched on the topic of coffee consumption, it is implausible to have all messages matched thoroughly on content. For example, because the selected news story

representing neutral/general information messages presented relatively newer information about coffee consumption compared to other news stories, experimental stimuli were not matched in terms of message novelty. This may explain the significantly increased surprise after exposure to the neutral/general information news story. To avoid cate-category confound, future research should consider multiple message exposures across distinct health topics.

Third, a "no information" condition was not included in the study as a control group. Despite having three consistent message conditions serving as comparisons, they all cued the topic of coffee consumption, about which contradictory health information exists. It is likely that exposure to these consistent messages may also prime participants to think about conflicting information about coffee consumption and thus affect subsequent cognitions and emotions. To establish a true baseline on these outcomes, future experimental work could include a "no information" or control condition presenting information about an unrelated health topic (e.g., a message about physical activities for the current study about coffee consumption).

Fourth, the current analyses regarding perceived conflict relied on a three-item measure (i.e., "the content is inconsistent/conflicting/contradictory"). Although this measure demonstrated strong internal consistency and was used in previous research (Chang, 2015), some might argue that three items essentially were the same, which may lead to low content validity. As said in an above footnote, I proposed several promising measures of perceived conflict but did not analyze them here. Given the centrality of perceived conflict in contradictory health information processing, future work should continue prioritizing measurement development and validity for this concept.

Fifth, while I focused on the potentially moderating effects of self-relevance, there might be other personal characteristics—such as research literacy, past exposure to contradictory information, and prior nutrition knowledge—that might influence effects of exposure to contradictory information but were not adjusted for or measured in the current study. To provide more practical implications regarding whether different strategies are needed for different subgroups when addressing adverse effects of exposure to conflict, future research should explore whether such effects vary by these personal characteristics.

Last, as explained in the literature review, there are two possible ways for people to encounter contradictory health information—contradictory messages (CM) or messages about contradiction (MC). Despite the inclusion of MC condition in the current study, I did not specifically test the information processing of MC. It is likely that effects of exposure to MC follow the similar causal pathway as observed for CM, which could be examined in future studies.

Conclusion

In conclusion, this dissertation tested whether effects of exposure to contradictory health messages operate through perceived conflict and whether such effects vary by self-relevance. Findings of a two-wave survey experiment suggest that perceived conflict functions as a mediator between exposure to contradictory messages and certain cognitive and affective outcomes, such as topic-specific confusion and anger. Empirical inconsistencies exist for other outcomes and across different approaches to mediation. Therefore, at this point, it is difficult to reach a clear conclusion about

whether perceived conflict always serves as a mediator in contradictory health information processing. Additionally, the findings indicate that those holding strong priors are more likely to engage in defensive processing of contradictory messages. However, this does not result in differential effects of exposure to contradictory messages. Future studies should explore whether such patterns persist for other health contexts (e.g., cancer screening, vaccination) where certain priors may be held more strongly. If so, interventions aimed at mitigating adverse effects of exposure to conflict can target resolving perceived conflict and may not need varying strategies for different self-relevance subgroups.

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APPENDIX A: Thought-listing exploratory study messages

Contradictory news headlines

Now we'd like you to read some news headlines about nutrition.

Moderate drinking can lower risk of heart attack, says study

Study: even moderate drinking ups risk of cancer

New advisory: eating fish twice a week to lower risk of heart attack and stroke

Study shows mercury in fish might be harmful

Organic milk 'is healthier' than conventional milk, study says

New study finds organic cow's milk is no better than regular milk

Scientific review finds coffee drinking linked with lower risk of cancers, death

Heavy coffee consumption linked to higher death risk

Now we'd like you to read some news headlines about electronic cigarettes (e-cigarettes). These are battery-powered, usually contain liquid nicotine, and produce vapor instead of smoke.

Smokers who switch to e-cigarettes may breathe fewer toxins

Lab tests hint at excess of formaldehyde in vapor from e-cigarettes

E-cigarettes found to provide some benefit

E-cigarette pose risks

'Vaping' is safer than smoking

Unsafe e-cigarettes

British study says electronic cigarettes curb smoking risks

Nicotine isn't the only hazard to be found in e-cigarettes

Now we'd like you to read some news headlines about mammography, which doctors use to check for breast cancer. USPSTF refers to the U.S. Preventive Services Task Force, and ACS refers to the American Cancer Society.

Breast cancer and mammograms: study suggests harms of screening, including 'widespread overdiagnosis'

Screening mammography lowers breast cancer patients' needs for aggressive treatment, study finds

USPSTF recommends against routine mammograms for women aged 40 to 49 years

ACS: women should begin getting mammograms every year at age 45

Now we'd like you to read some news headlines about prostate-specific antigen (PSA) testing, which doctors use to check for prostate cancer. USPSTF refers to the U.S. Preventive Services Task Force, and AUA refers to the American Urological Association.

PSA testing for prostate cancer: new study supports benefits

Health experts: routine PSA tests for prostate cancer not good for health

USPSTF no longer recommends against PSA-based screening

AUA recommends against routine PSA testing for prostate cancer

Contradictory news briefings

Now we'd like you to read two news briefs about drinking alcohol.

Moderate drinking can lower risk of heart attack, study says

Moderate drinking can lower the risk of several heart conditions, according to a study published in the *British Medical Journal*. The study of 1.93 million people in the UK aged over 30 found that moderate drinkers were less likely to experience heart attacks, heart failure, stroke, and circulation problems than non-drinkers.

Study: even moderate drinking ups risk of cancer

A new study published in the *British Medical Journal* suggests that even light and moderate drinking is associated with an increased risk of certain alcohol-related cancers. The study followed about 88,000 women and 48,000 men for up to 30 years and assessed the risk of cancers of the stomach, colon, breast, prostate, liver, and throat.

Now we'd like you to read two news briefs about electronic cigarettes (e-cigarettes). These are battery-powered, usually contain liquid nicotine, and produce vapor instead of smoke.

Smokers who switch to e-cigarettes may breathe fewer toxins

According to a British study published in the journal *Cancer Prevention Research*, smokers who switch to e-cigarettes may dramatically reduce their exposure to air toxins and harmful chemicals including carbon monoxide. The study adds to the growing body of evidence suggesting that e-cigarette devices might benefit the health of people who already smoke.

Lab tests hint at excess of formaldehyde in vapor from e-cigarettes

Lawrence Berkeley National Laboratory confirmed the presence of formaldehyde and other chemical compounds linked to cancer in e-cigarette vapor. The lab's calculations also indicate that at least two compounds in e-cigarette vapor exceed ceiling limits for chronic exposure. The study was published in the journal *Environmental Science and Technology*.

Now we'd like you to read two news briefs about mammography, which doctors use to check for breast cancer.

USPSTF recommends against routine mammograms for women aged 40 to 49 years

The U.S. Preventive Services Task Force (USPSTF) released an updated recommendation for breast cancer screening, which recommends against routine screening for women aged 40 to 49 years. For women aged 50 to 74 years, the USPSTF recommends screening mammography every other year.

ACS: women should begin getting mammograms every year at age 45

According to the American Cancer Society (ACS), women should be given the option to start screening for breast cancer at age 40 and get an annual mammogram every year from ages 45-54. From age 55, women can switch to getting mammograms every two years.

Now we'd like you to read two news briefs about prostate-specific antigen (PSA) testing, which doctors use to check for prostate cancer.

PSA testing for prostate cancer: new study supports benefits

The latest study published in the journal *Annals of Internal Medicine* concludes that PSA testing does help save lives from prostate cancer and is linked to a decrease in deaths, compared to men who aren't screened.

Health experts: routine PSA tests for prostate cancer not good for health

A top panel of health experts at the U.S. Preventive Services Task Force (USPSTF) says that men should no longer get routine PSA tests to screen for prostate cancer. The reason is that the tests may lead to treatments that do more harm than good.

APPENDIX B: Additional analysis of thought-listing exploratory study

Because perceptions of conflicting information may vary by personal relevance, I examined whether the level of perceived conflict after exposure to conflicting information about e-cigarettes varied by smoking status and whether the level of perceived conflict after exposure to conflicting information about mammography screening and PSA testing varied by gender.

Of all participants, 13% reported that they smoked cigarettes every day, 23.5% said they smoked cigarettes some days, and 63.5% indicated they did not smoke cigarettes at all. As for e-cigarette use, 71.5% indicated they did not use e-cigarettes at all, while 7% used e-cigarettes every day and 21.5% used e-cigarettes some days. Given the highly skewed distribution of then-current use of cigarettes and e-cigarettes across the responses of "every day," "some days," and "not at all," I combined the subgroups of respondents who indicated they smoked or used e-cigarettes "every day" and "some days." Thus, 36.5% of participants were categorized as current smokers while 63.5% were categorized as non-smokers. Similarly, 28.5% of participants were categorized as current vapers (i.e., e-cigarette users) while 71.5% were categorized as current non-vapers.

In analyses of thought-listing responses, perceived conflict was coded as "1" and no perceived conflict was coded as "0." This categorical variable was inputted as the dependent variable and smoking status and gender were inputted as independent variables, respectively. Logistic regressions were performed using SPSS Statistics version 27.

Logistic regressions of perceived conflict by smoking status and gender

	Headlines condition		Briefs condition	
	Odds ratio [95% CI]	P-value	Odds ratio [95% CI]	P-value
Perceived conflict after exposure to conflicting information about e-cigarettes				
Current smokers	.523 [.158, 1.732]	.289	.218 [.046, 1.042]	.056
Current vapers	.103 [.013, .814]	.031	.434 [.090, 2.094]	.298
Perceived conflict after exposure to conflicting information about mammography				
Female	1.393 [.530, 3.663]	.502	1.525 [.558, 4.167]	.410
Perceived conflict after exposure to conflicting information about PSA testing				
Female	1.441 [.580, 3.581]	.431	1.749 [.672, 4.789]	.244

Results of logistic regressions are presented above. In general, relevance did not seem to influence perceived conflict. However, non-vapers were more likely to report perceived conflict than vapers after exposure to contradictory news headlines about e-cigarettes. Given these inconsistent findings and limitations of small sample size and

reliability issue, it is difficult to reach a clear conclusion regarding the impact of relevance on perceived conflict.

APPENDIX C: Stimulus messages

Coffee consumption

Comparison condition 1_pros/benefits

New study suggests drinking coffee tied to lower risk of death

A new study found that people who drank coffee regularly were less likely to die of many causes, including heart disease and diabetes, than those who didn't drink coffee at all. After accounting for other factors like smoking, researchers found that coffee drinkers had a lower risk of death from heart disease, chronic respiratory diseases such as lung cancer, diabetes, pneumonia, flu, and suicide than nondrinkers.

This study, published in the American Journal of Epidemiology, also found that the more coffee people consumed, the lower their risk of dying from these illnesses. The benefits of drinking coffee seem to come from the components found in the coffee beans. "Coffee contains numerous biologically active compounds, including phenolic acids and caffeine, which are beneficial for health," said Dr. Erica Smith of the National Cancer Institute in Rockville, Maryland, who led this study.

"There is a growing number of high-quality studies that showed that people who drink more coffee tend to have better health outcomes," said Dr. Mark Gunther of the Imperial College London, who was not part of this new study. "Coffee can be part of a healthy, balanced lifestyle, and it may even do some good," Gunter said. "If you like drinking coffee, then carry on."

Comparison condition 2_cons/risks

Heavy coffee consumption linked to higher death risk, study suggests

A new study finds that drinking more than 2 cups of coffee per day is associated with a higher risk of early death from heart attacks and other cardiac issues. Death rates from all causes rose by more than half in these heavy coffee drinkers. The study, from the journal Mayo Clinic Proceedings, found that people who drank larger amounts of coffee were more likely to have less healthy lungs and hearts.

The team, led by Dr. Steve Norton at the University of South Carolina, warned that people might want to watch their coffee intake and avoid drinking large amounts of coffee. Coffee could stiffen the arteries, which in turn could heighten the risk of heart attacks and stroke. In addition, the process of roasting coffee beans creates acrylamide, a chemical that might cause cancer.

"Previous research has shown excessive coffee intake can cause your nervous system to send signals to constrict your blood vessels, which then increases your blood pressure

and makes your heart work harder," said Dr. Elena Hynes of the University of South Australia, who was not involved in the new study." Anything that makes your heart work harder, whether it is stress or heavy coffee consumption, can be bad for your heart, especially if this continues over long periods of time," she said.

Comparison condition 3_neutral/general information

Scientists create beanless coffee without the bitterness

A startup based in Seattle has developed a so-called molecular coffee, which promises to produce the perfect cup without using a single coffee bean. The science behind this molecular coffee enables the creation of a range of tastes and aromas.

The startup is experimenting with many coffee flavors and aromas, which they believe to be sufficiently attractive that consumers will not need to add milk or cream or sugar to their coffee. Following the development of laboratory-grown cultured meat, this could be another step towards a different type of food and beverage future-state.

Through a series of laboratory experiments over the past few years, the startup has identified some forty compounds found in coffee beans that are linked to the aromas and flavors of a good cup of coffee and which create enjoyment for the consumer. The company is experimenting with different compounds found in coffee to isolate the components that can be used to recreate the true aroma, mouth feel, and color of real coffee.

This startup also wants to ensure that their product has a low environmental impact, so it is developing the coffee from natural, sustainable ingredients. Its goal is to offset the damage due to deforestation caused by the coffee industry and to lower the costs of transporting coffee beans worldwide.

Contradictory messages (CM) condition[12]

New study suggests drinking coffee tied to lower risk of death

A new study found that people who drank coffee regularly were less likely to die of many causes, including heart disease and diabetes, than those who didn't drink coffee at all. After accounting for other factors like smoking, researchers found that coffee drinkers had a lower risk of death from heart disease, chronic respiratory diseases such as lung cancer, diabetes, pneumonia, flu, and suicide than nondrinkers.

This study, published in the American Journal of Epidemiology, also found that the more coffee people consumed, the lower their risk of dying from these illnesses. The benefits of drinking coffee seem to come from the components found in the coffee

[12] For the contradictory messages condition, the order of seeing the news story about benefits or harms was fully randomized.

beans. “Coffee contains numerous biologically active compounds, including phenolic acids and caffeine, which are beneficial for health,” said Dr. Erica Smith of the National Cancer Institute in Rockville, Maryland, who led this study.

“There is a growing number of high-quality studies that showed that people who drink more coffee tend to have better health outcomes,” said Dr. Mark Gunther of the Imperial College London, who was not part of this new study. “Coffee can be part of a healthy, balanced lifestyle, and it may even do some good,” Gunter said. “If you like drinking coffee, then carry on.”

Heavy coffee consumption linked to higher death risk, study suggests

A new study finds that drinking more than 2 cups of coffee per day is associated with a higher risk of early death from heart attacks and other cardiac issues. Death rates from all causes rose by more than half in these heavy coffee drinkers. The study, from the journal Mayo Clinic Proceedings, found that people who drank larger amounts of coffee were more likely to have less healthy lungs and hearts.

The team, led by Dr. Steve Norton at the University of South Carolina, warned that people might want to watch their coffee intake and avoid drinking large amounts of coffee. Coffee could stiffen the arteries, which in turn could heighten the risk of heart attacks and stroke. In addition, the process of roasting coffee beans creates acrylamide, a chemical that might cause cancer.

"Previous research has shown excessive coffee intake can cause your nervous system to send signals to constrict your blood vessels, which then increases your blood pressure and makes your heart work harder," said Dr. Elena Hynes of the University of South Australia, who was not involved in the new study." Anything that makes your heart work harder, whether it is stress or heavy coffee consumption, can be bad for your heart, especially if this continues over long periods of time," she said.

Message about contradiction (MC) condition

An increasing number of studies involving coffee consumption provide conflicting results

Nearly two-thirds of Americans drink at least one cup of coffee a day. We cannot get enough coffee, it seems, but do we know whether coffee is good or bad for our health? Numerous studies investigating the benefits and harms of coffee have produced conflicting results.

For years, doctors warned people to avoid coffee because it might increase the risk of heart and lung diseases. Experts also worried that coffee had damaging effects on the

digestive tract, which could lead to stomach ulcers, heartburn, and other digestive illnesses.

A new study seems to support this concern, as it finds that drinking more than 2 cups of coffee per day is associated with a higher risk of early death from heart attacks and other cardiac issues. Death rates from all causes rose by more than half in these heavy coffee drinkers. The study, from the journal Mayo Clinic Proceedings, found that people who drank larger amounts of coffee were more likely to have less healthy lungs and hearts. The team, led by Dr. Steve Norton at the University of South Carolina, warned that people might want to watch their coffee intake and avoid drinking large amounts of coffee.

Given this bad news, you might consider reducing your coffee intake based on health concerns. But there has been a history of medical flip-flops on how coffee may affect your health, with some studies warning of risks while others find evidence of benefits.

For example, a new study, published in the American Journal of Epidemiology, found that people who drank coffee regularly were less likely to die of many causes, including heart disease and diabetes, than those who didn't drink coffee at all. After accounting for other factors like smoking, researchers found that coffee drinkers had a lower risk of death from heart disease, chronic respiratory diseases such as lung cancer, diabetes, pneumonia, flu, and suicide than nondrinkers. The benefits of drinking coffee seem to come from the components found in the coffee beans. "Coffee contains numerous biologically active compounds, including phenolic acids and caffeine, which are beneficial for health," said Dr. Erica Smith of the National Cancer Institute in Rockville, Maryland, who led this study.

"The findings from studies investigating the benefits and harms of coffee are all over the place," said Dr. Lisa Goldberg, a cardiologist and medical director at NYU Langone Health in New York, who was not part of the two studies. Given these conflicting findings, it remains unclear whether coffee is good or bad for you. Because coffee still stirs debate, scientists say more research is needed.

APPEDNIX D: Analysis of pilot study

Means of perceived conflict and credibility by condition and health topic

Health topic	Condition				
	Pros/benefits condition	Cons/risks condition	Neural/general information condition	Contradictory messages condition	Messages about contradiction condition
The content was contradictory/inconsistent/conflicting.					
Coffee	1.92 (.68)	1.76 (.62)	1.70 (.68)	4.38 (.68)	3.57 (1.25)
Vitamins	1.98 (.88)	2.68 (1.03)	1.62 (.85)	3.40 (1.09)	3.35 (1.04)
Fish	1.57 (.82)	1.68 (.91)	2.13 (.87)	3.82 (.96)	3.22 (1.09)
Chocolate	1.97 (.88)	2.42 (1.06)	2.05 (.78)	3.84 (1.41)	2.98 (1.16)
Organic foods	2.04 (1.09)	2.62 (.93)	1.84 (.70)	4.05 (.83)	3.84 (.91)
Low-carb foods	2.12 (.67)	2.70 (.92)	2.40 (1.11)	4.00 (.95)	3.25 (1.02)
Vigorous exercise	1.75 (.92)	2.77 (.98)	1.84 (.62)	4.06 (.84)	3.75 (.90)
Eggs	1.75 (.89)	2.03 (.98)	2.03 (.81)	4.28 (.66)	3.54 (1.16)
The content was credible/believable.					
Coffee	3.58 (.96)	3.83 (.78)	3.30 (.94)	3.30 (.85)	3.60 (.79)
Vitamins	4.13 (.57)	3.34 (.88)	4.23 (.53)	3.69 (.95)	3.82 (.61)
Fish	4.14 (.82)	4.23 (.66)	3.68 (1.03)	3.98 (.72)	4.02 (.51)
Chocolate	3.63 (.92)	3.98 (.85)	3.89 (.68)	3.76 (.82)	4.00 (.72)
Organic foods	4.25 (.46)	3.25 (.79)	3.88 (.57)	3.48 (.73)	3.67 (.83)
Low-carb foods	3.63 (.67)	3.45 (.95)	3.95 (.81)	3.33 (.99)	3.74 (.86)
Vigorous exercise	4.30 (.73)	2.98 (1.29)	4.18 (.53)	3.07 (.94)	3.88 (.88)
Eggs	4.10 (.62)	3.61 (.82)	3.85 (.80)	3.25 (.80)	3.95 (.52)

Note. All responses were reported on a 5-point scale.

APPEDNIX E: Wave 1 Questionnaire

INFORMATION SHEET FOR RESEARCH

Public Response to Health Information in the Media

You are invited to be in a research study to better understand how people respond to health information in the media. You were selected as a possible participant because you are a Prolific Academic worker who is eligible to participate. This research includes 2 surveys on health-related topics. We will invite you to complete the second survey in about 7-10 days. To thank you for sharing your opinions, we will give you a reward of $1.00 after completing this survey. If you complete both surveys, you will earn a total reward of $2.50. We ask that you read this form and ask any questions you may have before agreeing to be in the study. This study is being conducted by Dr. Rebekah Nagler and her doctoral student, Weijia Shi, in the Hubbard School of Journalism & Mass Communication at the University of Minnesota.

Procedures: If you agree to be in this study, we will ask you a few questions about your health behaviors. The survey will take about 5 minutes.
Confidentiality: The records of this study will be kept private. In any sort of report we might publish, we will not include any information that will make it possible to identify a subject. Research records will be stored securely and only researchers will have access to the records.
Voluntary Nature of the Study: Participation in this study is voluntary. Your decision whether or not to participate will not affect your current or future relations with the University of Minnesota. Participants are free to not answer any question or withdraw at any time without affecting those relationships.
Contacts and Questions: The researchers conducting this study are Dr. Rebekah Nagler and Weijia Shi. You may ask any questions you have now. If you have questions later, **you are encouraged** to contact them at nagle026@umn.edu or shixx589@umn.edu. This research has been reviewed and approved by an IRB within the Human Research Protections Program (HRPP). To share feedback privately with the HRPP about your research experience, call the Research Participants' Advocate Line at 612-625-1650 (Toll Free: 1-888-224-8636) or go to z.umn.edu/participants. You are encouraged to contact the HRPP if:

- Your questions, concerns, or complaints are not being answered by the research team.
- You cannot reach the research team.
- You want to talk to someone besides the research team.
- You have questions about your rights as a research participant.
- You want to get information or provide input about this research.

Please indicate below if you wish to continue with the study.

- ○ I give my consent to participate in the study and wish to continue.
- ○ I do not give my consent to participate in the study and do not wish to continue.

Before you start, please switch off phone/ e-mail/ music so you can focus on this study. Thank you!

We'd like to begin by asking you some questions about your health behaviors.

Please look at a list of behaviors. During the past 30 days, how often did you perform the following behaviors?

	Never	Rarely (less than once a week)	Sometimes (1-2 times per week)	Often (3-5 times per week)	Every day (once a day or more)
Drinking Coffee	○	○	○	○	○
Eating fish	○	○	○	○	○
Taking vitamins/ supplements	○	○	○	○	○
Eating chocolate	○	○	○	○	○
Eating organic foods	○	○	○	○	○
Doing high-intensity physical activity or exercise that causes heavy sweating or large increases in breathing or heart rate (some examples are running, lap swimming, aerobics classes or fast bicycling)	○	○	○	○	○
Eating low-carbohydrate (low-carb) foods	○	○	○	○	○
Eating eggs	○	○	○	○	○

To me, drinking coffee:

	1	2	3	4	5	6	7	
Means nothing	○	○	○	○	○	○	○	Means a lot
Is unimportant	○	○	○	○	○	○	○	Is important
Is worthless	○	○	○	○	○	○	○	Is valuable
Is unnecessary	○	○	○	○	○	○	○	Is necessary
Is irrelevant	○	○	○	○	○	○	○	Is relevant

To me, eating fish:

	1	2	3	4	5	6	7	
Means nothing	○	○	○	○	○	○	○	Means a lot
Is unimportant	○	○	○	○	○	○	○	Is important
Is worthless	○	○	○	○	○	○	○	Is valuable
Is unnecessary	○	○	○	○	○	○	○	Is necessary
Is irrelevant	○	○	○	○	○	○	○	Is relevant

To me, taking vitamins/supplements:

	1	2	3	4	5	6	7	
Means nothing	○	○	○	○	○	○	○	Means a lot
Is unimportant	○	○	○	○	○	○	○	Is important
Is worthless	○	○	○	○	○	○	○	Is valuable
Is unnecessary	○	○	○	○	○	○	○	Is necessary
Is irrelevant	○	○	○	○	○	○	○	Is relevant

To me, eating chocolate:

	1	2	3	4	5	6	7	
Means nothing	○	○	○	○	○	○	○	Means a lot
Is unimportant	○	○	○	○	○	○	○	Is important
Is worthless	○	○	○	○	○	○	○	Is valuable
Is unnecessary	○	○	○	○	○	○	○	Is necessary
Is irrelevant	○	○	○	○	○	○	○	Is relevant

To me, eating organic foods:

	1	2	3	4	5	6	7	
Means nothing	○	○	○	○	○	○	○	Means a lot
Is unimportant	○	○	○	○	○	○	○	Is important
Is worthless	○	○	○	○	○	○	○	Is valuable
Is unnecessary	○	○	○	○	○	○	○	Is necessary
Is irrelevant	○	○	○	○	○	○	○	Is relevant

To me, doing high-intensity physical activity or exercise that causes heavy sweating or large increases in breathing or heart rate (some examples are running, lap swimming, aerobics classes or fast bicycling):

	1	2	3	4	5	6	7	
Means nothing	○	○	○	○	○	○	○	Means a lot
Is unimportant	○	○	○	○	○	○	○	Is important
Is worthless	○	○	○	○	○	○	○	Is valuable
Is unnecessary	○	○	○	○	○	○	○	Is necessary
Is irrelevant	○	○	○	○	○	○	○	Is relevant

To me, eating low-carbohydrate (low-carb) foods:

	1	2	3	4	5	6	7	
Means nothing	○	○	○	○	○	○	○	Means a lot
Is unimportant	○	○	○	○	○	○	○	Is important
Is worthless	○	○	○	○	○	○	○	Is valuable
Is unnecessary	○	○	○	○	○	○	○	Is necessary
Is irrelevant	○	○	○	○	○	○	○	Is relevant

To me, eating eggs:

	1	2	3	4	5	6	7	
Means nothing	○	○	○	○	○	○	○	Means a lot
Is unimportant	○	○	○	○	○	○	○	Is important
Is worthless	○	○	○	○	○	○	○	Is valuable
Is unnecessary	○	○	○	○	○	○	○	Is necessary
Is irrelevant	○	○	○	○	○	○	○	Is relevant

Now we'd like to ask you some questions about concepts sometimes used in news stories.

Some news stories use specific terminology. For each term listed below, do you have a clear understanding of what the term means, a general sense of what the term means, or little understanding of what the term means?

	Little understanding of what this term means	A general sense of what this term means	A clear understanding of what this term means
Scientific study	○	○	○
Clinical trials (or randomized controlled trials)	○	○	○
Cause-and-effect relationships (as opposed to associations)	○	○	○

We'd also like to ask you some questions about scientific research.

A doctor tells a couple that their genetic makeup means that they've got one in four chances of having a child with an inherited illness.

	Yes	No	I'm not sure
Does this mean that if their first child has the illness, the next three will not have the illness?	○	○	○
Does this mean that each of the couple's children will have the same risk of suffering from the illness?	○	○	○

Two scientists want to know if a certain drug is effective against high blood pressure. The first scientist wants to give the drug to 1,000 people with high blood pressure and see how many of them experience lower blood pressure levels. The second scientist wants to give the drug to 500 people with high blood pressure and not give the drug to another 500 people with high blood pressure, and see how many in both groups experience lower blood pressure levels. Which is the better way to test this drug?

- ○ The first one
- ○ The second one
- ○ I'm not sure

Before concluding the survey, we'd like to ask some questions about yourself.

What is your age?

_____

What is the highest grade or level of schooling you completed?

- ○ Less than 8 years
- ○ 8 through 11 years
- ○ 12 years or completed high school
- ○ Post high school training other than college (vocational or technical)
- ○ Some college, no degree
- ○ Associate's degree
- ○ Bachelor's degree (4-year)
- ○ Master's degree
- ○ Professional or Doctorate degree

Are you of Hispanic, Latino/a, or Spanish origin?

- ○ Yes
- ○ No

What is your race? One or more categories may be selected.

- ☐ White
- ☐ Black or African American
- ☐ American Indian or Alaska Native
- ☐ Asian
- ☐ Native Hawaiian or Pacific Islander

What best describes your gender?

- ○ Male
- ○ Female
- ○ Prefer not to say
- ○ Prefer to self-describe:

Please enter your Prolific ID here:

_____

As a reminder, this research includes 2 surveys on health-related topics. **We will invite you to complete the second survey in about 7-10 days**. To thank you for sharing your opinions, we will give you a reward of $1.00 after completing this survey. If you complete both surveys, you will earn a total reward of $2.50.

Thank you for participating in the study!

CONTACTS AND QUESTIONS: The researchers conducting this study are Rebekah Nagler (nagle026@umn.edu), Associate Professor, and her Doctoral student, Weijia Shi (shixx589@umn.edu) at the Hubbard School of Journalism and Mass Communication, University of Minnesota. You may contact the researchers with any questions. If you have any questions or concerns regarding the study and would like to talk to someone other than the researchers, you are encouraged to contact the Research Participants' Advocate Line at 612-625-1650 or go to https://research.umn.edu/units/hrpp/research-participants/questions-concerns.

Your completion code is 50E2075C. Please enter it manually in the Prolific app when you return.

APPENDIX F: Wave 1 sample characteristics

Sample characteristics

Characteristics	*n* (%)
Age	
18-30	1048 (53.9%)
31-45	607 (31.2%)
46-60	223 (11.5%)
61 or older	64 (3.3%)
Gender	
Male	959 (49.3%)
Female	950 (48.9%)
Prefer not to say	11 (0.6%)
Prefer to self-describe	24 (1.2%)
Education	
Less than 8 years	1 (0.1%)
8 through 11 years	16 (0.8%)
12 years or completed high school	234 (12.0%)
Post high school training other than college	45 (2.3%)
Some college, no degree	460 (23.7%)
Associate degree	165 (8.5%)
Bachelor's degree	701 (36.1%)
Master's degree	250 (12.9%)
Professional or Doctorate degree	72 (3.7%)
Race/ethnicity	
White	1264 (65.0%)
Black or African American	126 (6.5%)
Asian	255 (13.1%)
American Indian or Alaska Native	5 (0.3%)
Native Hawaiian or Pacific Islander	3 (0.2%)
Hispanic/Latino	11 (0.6%)
2+ races	277 (14.2%)

Note. $N = 1944$.

APPEDNIX G: Wave 2 Questionnaire

INFORMATION SHEET FOR RESEARCH

Public Response to Health Information in the Media

You are invited to continue your participation in a research study to better understand how people respond to health information in the media. You were selected as a possible participant because you are a Prolific Academic worker who is eligible to participate. We ask that you read this form and ask any questions you may have before agreeing to be in the study. This study is being conducted by Dr. Rebekah Nagler and her doctoral student, Weijia Shi, in the Hubbard School of Journalism & Mass Communication at the University of Minnesota.

Procedures: If you agree to continue to participate in this study, we will ask you to look at some health information in the news media and answer a few questions. The survey will take about 7 minutes.
Confidentiality: The records of this study will be kept private. In any sort of report we might publish, we will not include any information that will make it possible to identify a subject. Research records will be stored securely and only researchers will have access to the records.
Voluntary Nature of the Study: Participation in this study is voluntary. Your decision whether or not to participate will not affect your current or future relations with the University of Minnesota. Participants are free to not answer any question or withdraw at any time without affecting those relationships.
Contacts and Questions: The researchers conducting this study are Dr. Rebekah Nagler and Weijia Shi. You may ask any questions you have now. If you have questions later, **you are encouraged** to contact them at nagle026@umn.edu or shixx589@umn.edu. This research has been reviewed and approved by an IRB within the Human Research Protections Program (HRPP). To share feedback privately with the HRPP about your research experience, call the Research Participants' Advocate Line at 612-625-1650 (Toll Free: 1-888-224-8636) or go to z.umn.edu/participants. You are encouraged to contact the HRPP if:

- Your questions, concerns, or complaints are not being answered by the research team.
- You cannot reach the research team.
- You want to talk to someone besides the research team.
- You have questions about your rights as a research participant.
- You want to get information or provide input about this research.

Please indicate below if you wish to continue with the study.

- ○ I give my consent to participate in the study and wish to continue.
- ○ I do not give my consent to participate in the study and do not wish to continue.

Before you start, please switch off phone/ e-mail/ music so you can focus on this study. Thank you!

We'd like you to read one or two short health news stories. Please read the content carefully and respond to a few questions that follow. You will not be able to go back to the news story afterwards. For the purposes of this research study, please note that we have removed all paid advertising content, as well as the media source.

Wave 2 Study 2 Post Measures

Display This Question:

If Condition = Pros/benefits, Cons/risks, Neutral/general information

[STUDY STIMULI]

We're now interested in what you were thinking about when you were reading the news story. Please use the text box below to record your thoughts and ideas. You should try to record only those ideas that you were thinking when reading the news story. Don't worry about spelling and grammar. Please be completely honest and list all of the thoughts that you had.

_____

_____

_____

_____

_____

Please indicate whether you think the content of the news story you just read was:

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Contradictory	○	○	○	○	○
Inconsistent	○	○	○	○	○
Conflicting	○	○	○	○	○

Think back to the news story that you read earlier. **On a scale from 0 to 100, how much discussion about health information that always seems to be changing did you notice in the news story you read?**
Zero (0) indicates **no** information that always seems to be changing
One hundred (100) indicates **a lot** of information that always seems to be changing

Please move the slider on the scale below.

0 10 20 30 40 50 60 70 80 90 100

Think back to the news story that you read earlier. **On a scale from 0 to 100, to what degree you think the study findings discussed in the story contradict one another?**
Zero (0) indicates you think **no** study findings contradict one another
One hundred (100) indicates you think **a lot** of study findings contradict one another

Please move the slider on the scale below.

0 10 20 30 40 50 60 70 80 90 100

Based on the news story you just read, please indicate if you agree or disagree with the following statements.

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
I noticed that study findings were in opposition.	○	○	○	○	○
Scientists always disagree with each other.	○	○	○	○	○
It seems that research studies reach similar conclusions.	○	○	○	○	○
Experts claim conflicting opinions from time to time.	○	○	○	○	○

Based on what you just read, please answer the following questions.

	Not at all (1)	(2)	(3)	(4)	Very much (5)
While reading the news story, were you thinking of points that went against the argument?	○	○	○	○	○
While reading the news story, were you feeling skeptical of the argument?	○	○	○	○	○
Were you criticizing the news story while you were reading it?	○	○	○	○	○

The information in the news story was:

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Exaggerated	○	○	○	○	○
Distorted	○	○	○	○	○
Overstated	○	○	○	○	○
Overblown	○	○	○	○	○
Please select "Agree"	○	○	○	○	○

Think back to the news story you read earlier. Would you say the news story was negative, positive or a mix of both?

- ○ Completely negative
- ○ Mostly negative
- ○ A mix of both
- ○ Mostly positive
- ○ Completely positive

Display This Question:

If Condition = Contradictory messages

[STUDY STIMULI]

We're now interested in what you were thinking about when you were reading the news stories. Please use the text box below to record your thoughts and ideas. You should try to record only those ideas that you were thinking when reading the news stories. Don't worry about spelling and grammar. Please be completely honest and list all of the thoughts that you had.

_____

_____

_____

_____

_____

Please indicate whether you think the content of the news stories you just read was:

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Contradictory	○	○	○	○	○
Inconsistent	○	○	○	○	○
Conflicting	○	○	○	○	○

Think back to the news stories that you read earlier. **On a scale from 0 to 100, how much discussion about health information that always seems to be changing did you notice in the news stories you read?**

Zero (0) indicates **no** information that always seems to be changing
One hundred (100) indicates **a lot** of information that always seems to be changing

Please move the slider on the scale below.

0 10 20 30 40 50 60 70 80 90 100

Think back to the news stories that you read earlier. **On a scale from 0 to 100, to what degree you think the study findings discussed in the stories contradict one another?**

Zero (0) indicates you think **no** study findings contradict one another
One hundred (100) indicates you think **a lot** of study findings contradict one another

Please move the slider on the scale below.

0 10 20 30 40 50 60 70 80 90 100

Based on the news stories you just read, please indicate if you agree or disagree with the following statements.

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
I noticed that study findings were in opposition.	○	○	○	○	○
Scientists always disagree with each other.	○	○	○	○	○
It seems that research studies reach similar conclusions.	○	○	○	○	○
Experts claim conflicting opinions from time to time.	○	○	○	○	○

Based on what you just read about the news story, **"New study suggests drinking coffee tied to lower risk of death"**, please answer the following questions.

	Not at all (1)	(2)	(3)	(4)	Very much (5)
While reading the news story, were you thinking of points that went against the argument?	○	○	○	○	○
While reading the news story, were you feeling skeptical of the argument?	○	○	○	○	○
Were you criticizing the news story while you were reading it?	○	○	○	○	○

The information in the news story, **"New study suggests drinking coffee tied to lower risk of death",** was:

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Exaggerated	○	○	○	○	○
Distorted	○	○	○	○	○
Overstated	○	○	○	○	○
Overblown	○	○	○	○	○
Please select "Agree"	○	○	○	○	○

Based on what you just read about the news story, **"Heavy coffee consumption linked to higher death risk, study suggests"**, please answer the following questions.

	Not at all (1)	(2)	(3)	(4)	Very much (5)
While reading the news story, were you thinking of points that went against the argument?	○	○	○	○	○
While reading the news story, were you feeling skeptical of the argument?	○	○	○	○	○
Were you criticizing the news story while you were reading it?	○	○	○	○	○

The information in the news story, **"Heavy coffee consumption linked to higher death risk, study suggests"**, was:

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Exaggerated	○	○	○	○	○
Distorted	○	○	○	○	○
Overstated	○	○	○	○	○
Overblown	○	○	○	○	○

Think back to the news stories you read earlier. Would you say the news stories were negative, positive or a mix of both?

- ○ Completely negative
- ○ Mostly negative
- ○ A mix of both
- ○ Mostly positive
- ○ Completely positive

Wave 2 Study 2 Post Measures

[STUDY STIMULI]

The next questions consist of a number of words that describe different feelings and emotions.

Please indicate how you feel having read the news content.

	Very little (1)	(2)	(3)	(4)	Very much (5)
Fearful	○	○	○	○	○
Nervous	○	○	○	○	○
Anxious	○	○	○	○	○
Worried	○	○	○	○	○

Please indicate how you feel having read the news content.

	Very little (1)	(2)	(3)	(4)	Very much (5)
Frustrated	○	○	○	○	○
Irritated	○	○	○	○	○
Angry	○	○	○	○	○
Annoyed	○	○	○	○	○

Please indicate how you feel having read the news content.

	Very little (1)	(2)	(3)	(4)	Very much (5)
Amazed	○	○	○	○	○
Surprised	○	○	○	○	○
Astonished	○	○	○	○	○

Now we'd like to ask you some questions about your perceptions of health research.

Please indicate if you agree or disagree with the following statements.

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
It is not clear to me whether drinking coffee is best for me.	○	○	○	○	○
I find research on coffee consumption to be confusing.	○	○	○	○	○
Research findings on coffee consumption make sense to me.	○	○	○	○	○

Please indicate if you agree or disagree with the following statements.

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
I have mixed feelings about drinking coffee.	○	○	○	○	○
I am torn about drinking coffee.	○	○	○	○	○
I am indecisive about drinking coffee.	○	○	○	○	○

Please indicate if you agree or disagree with the following statements.

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
It is not always clear to me what foods are best for me.	○	○	○	○	○
I find nutrition recommendations to be confusing.	○	○	○	○	○
Nutrition research findings make sense to me.	○	○	○	○	○
I know what I should be eating to stay healthy.	○	○	○	○	○
I find nutrition research studies hard to follow.	○	○	○	○	○
I understand scientists' recommendations about what foods I should eat.	○	○	○	○	○

Please indicate if you agree or disagree with the following statements.

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
I am tired of hearing about what foods I should or should not eat.	○	○	○	○	○
Scientific research provides good guidance about the best foods to eat.	○	○	○	○	○
The evidence about healthy food choices is growing.	○	○	○	○	○
Dietary recommendations should be taken with a grain of salt.	○	○	○	○	○
Scientists really don't know what foods are good for you.	○	○	○	○	○
I pay attention to new research on food and nutrition.	○	○	○	○	○

Now we'd like to ask your opinions about the news media.

How much of the time do you think you can trust media organizations to report health news fairly?

- ○ Just about always
- ○ Most of the time
- ○ Only some of the time
- ○ None of the time

Think about the news media in general, please indicate whether you think they:

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Are fair	○	○	○	○	○
Tell the whole story	○	○	○	○	○
Are accurate	○	○	○	○	○
Can be trusted	○	○	○	○	○
Please select "Agree"	○	○	○	○	○

Please indicate whether you agree or disagree with the following statements:

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
It's important to critically evaluate what news stories say.	○	○	○	○	○
I think about news stories before I accept them as believable.	○	○	○	○	○
I am questioning which information is accurate in the news media.	○	○	○	○	○
I always think twice about statements made in news stories.	○	○	○	○	○

Based on the health news information you saw earlier, please indicate whether you think the news content you saw was:

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Contradictory	○	○	○	○	○
Inconsistent	○	○	○	○	○
Conflicting	○	○	○	○	○

Finally, we'd like to ask you a few questions about your experience with the COVID-19 pandemic.

How closely have you been following news about the outbreak of the coronavirus strain known as COVID-19?

- ○ Very closely
- ○ Fairly closely
- ○ Not too closely
- ○ Not at all closely

How well do you think the news media have covered the coronavirus outbreak?

- ○ Very well
- ○ Somewhat well
- ○ Not too well
- ○ Not at all well

How well do you think public health officials have responded to the coronavirus outbreak?

- ○ Very well
- ○ Somewhat well
- ○ Not too well
- ○ Not at all well

Thinking about the mix of news and information you have gotten about the coronavirus outbreak, which better describes you?

- ○ I have mostly seen the same set of facts across the sources I turn to for news
- ○ I have mostly seen conflicting facts across the sources I turn to for news
- ○ I haven't followed coronavirus news across multiple sources

Which of the following statements comes closer to how you feel? I feel the need to...

- ○ Take breaks from the news about the coronavirus outbreak
- ○ Stay tuned in to news about the coronavirus outbreak

Does keeping up with news about the coronavirus outbreak make you feel...

- ○ Better emotionally
- ○ Worse emotionally
- ○ Doesn't change my emotions

Please double check your Prolific ID here and then submit your survey below after reading our debriefing info.

Prolific ID:

Thank you very much for participating in the study. Please note that the news story you read might have been edited for the purposes of this research. We are interested in people's responses to conflict about research findings. Some people read news stories based on real study findings. These stories were modified so that in one version there was explicit conflict about the findings, whereas in other versions there was no conflict about the findings.

CONTACTS AND QUESTIONS: The researchers conducting this study are Rebekah Nagler (nagle026@umn.edu), Associate Professor, and her Doctoral student, Weijia Shi (shixx589@umn.edu) at the Hubbard School of Journalism and Mass Communication, University of Minnesota. You may contact the researchers with any questions. If you have any questions or concerns regarding the study and would like to talk to someone other than the researchers, you are encouraged to contact the Research Participants' Advocate Line at 612-625-1650 or go to https://research.umn.edu/units/hrpp/research-participants/questions-concerns.

APPENDIX H: Wave 2 sample characteristics

Wave 2 Study 1 sample characteristics

Characteristics	*n* (%)
Age	
18-30	335 (51.6%)
31-45	208 (32.0%)
46-60	83 (12.8%)
61 or older	23 (3.5%)
Gender	
Male	329 (50.7%)
Female	308 (47.5%)
Prefer not to say	5 (0.8%)
Prefer to self-describe	7 (1.1%)
Education	
Less than 8 years	1 (0.2%)
8 through 11 years	6 (0.9%)
12 years or completed high school	74 (11.4%)
Post high school training other than college	14 (2.2%)
Some college, no degree	141 (21.7%)
Associate degree	57 (8.8%)
Bachelor's degree	229 (35.3%)
Master's degree	95 (14.6%)
Professional or Doctorate degree	32 (4.9%)
Race/ethnicity	
White	434 (66.9%)
Black or African American	38 (5.9%)
Asian	96 (14.8%)
American Indian or Alaska Native	2 (0.3%)
Native Hawaiian or Pacific Islander	1 (0.2%)
Hispanic/Latino	1 (0.2%)
2+ races	77 (11.9%)

Note. $N = 649$.

Wave 2 Study 2 sample characteristics

Characteristics	*n* (%)
Age	
18-30	455 (53.8%)
31-45	265 (31.3%)
46-60	91 (10.8%)
61 or older	35 (4.1%)
Gender	
Male	413 (48.8%)
Female	419 (49.5%)
Prefer not to say	3 (0.4%)
Prefer to self-describe	11 (1.3%)
Education	
Less than 8 years	0 (0%)
8 through 11 years	9 (1.1%)
12 years or completed high school	97 (11.5%)
Post high school training other than college	19 (2.2%)
Some college, no degree	193 (22.8%)
Associate degree	73 (8.6%)
Bachelor's degree	321 (37.9%)
Master's degree	103 (12.2%)
Professional or Doctorate degree	31 (3.7%)
Race/ethnicity	
White	532 (62.9%)
Black or African American	51 (6.0%)
Asian	117 (13.8%)
American Indian or Alaska Native	3 (0.4%)
Native Hawaiian or Pacific Islander	1 (0.1%)
Hispanic/Latino	7 (0.8%)
2+ races	134 (15.8%)

Note. $N = 846$.

Wave 2 Study 2 COVID-related responses

Items	*n* (%)
How closely have you been following news about the outbreak of the coronavirus strain known as COVID-19?	
Very closely	264 (31.2%)
Fairly closely	443 (52.4%)
Not too closely	125 (14.8%)
Not at all closely	14 (1.7%)
How well do you think the news media have covered the coronavirus outbreak?	
Very well	117 (13.8%)
Somewhat well	465 (55.0%)
Not too well	197 (23.3%)
Not at all well	67 (7.9%)
How well do you think public health officials have responded to the coronavirus outbreak?	
Very well	64 (7.6%)
Somewhat well	268 (31.7%)
Not too well	338 (40.0%)
Not at all well	176 (20.8%)
Think about the mix of news and information you have gotten about the coronavirus outbreak, which better describes you?	
I have mostly seen the same set of facts across the sources I turn to for news	428 (50.6%)
I have mostly seen conflicting facts across the sources I turn to for news	362 (42.8%)
I haven't followed coronavirus news across multiple sources	56 (6.6%)
Which of the following statements comes closer to how you feel? I feel the need to…	
Take breaks from the news about the coronavirus outbreak	578 (68.3%)
Stay tuned in on news about the coronavirus outbreak	268 (31.7%)
Does keeping up with news about coronavirus outbreak make you feel…	
Better emotionally	52 (6.1%)
Worse emotionally	478 (56.5%)
Doesn't change my emotions	316 (37.4%)

Note. $N = 846$.